United States Patent [19]

Comstock et al.

[11] **3,739,668**

[45] **June 19, 1973**

[54] **APPARATUS FOR CUTTING AND HANDLING BLOCK-LINE ARTICLES**

[75] Inventors: **Alfred E. Comstock**, Frontenac, Minn.; **Burdsal Gardner Wilcox**, Oakland, Calif.

[73] Assignee: **Safeway Stores Incorporated**, Oakland, Calif.

[22] Filed: **June 28, 1971**

[21] Appl. No.: **157,747**

Related U.S. Application Data

[60] Continuation of Ser. No. 36,718, May 13, 1970, abandoned, which is a division of Ser. No. 780,009, Nov. 29, 1968, which is a division of Ser. No. 402,746, Oct. 9, 1964.

[52] **U.S. Cl.** **83/102,** 83/124, 83/267, 83/566

[51] **Int. Cl.**..... **B26d 3/24,** B26d 7/06, B26d 7/18

[58] **Field of Search** 146/155, 158, 160, 146/169, 6; 83/114, 124, 267, 102, 566; 31/21, 26, 30

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Primary Examiner—Willie G. Abercrombie

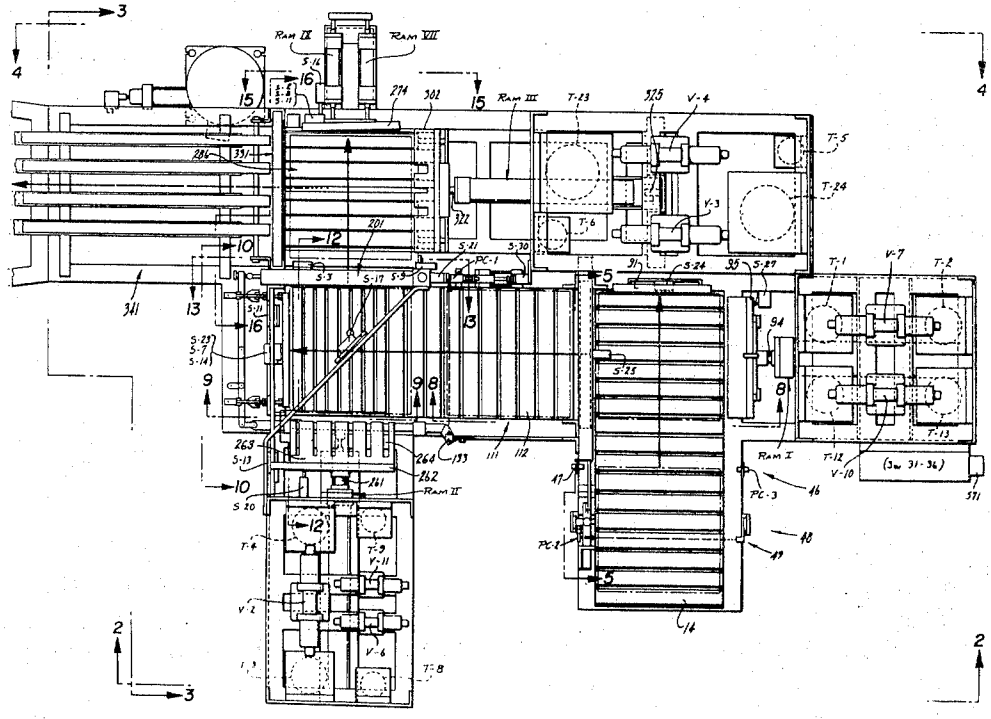
Attorney—Flehr, Hohbach, Test, Albritton & Herbert

[57] **ABSTRACT**

Apparatus for cutting articles by measuring one dimension of the article and cutting the article into a plurality of separate parts, each of which has a dimension which is proportional to the dimension measured.

Apparatus for cutting and handling articles having a platform with means for advancing the articles onto the platform. Dies engage the article on the platform to cut parts of predetermined shapes from the article. Means is provided for ejecting the articles from the dies and then for rotating the articles for cutting additional parts from the article.

10 Claims, 48 Drawing Figures



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SHEET 01 OF 30

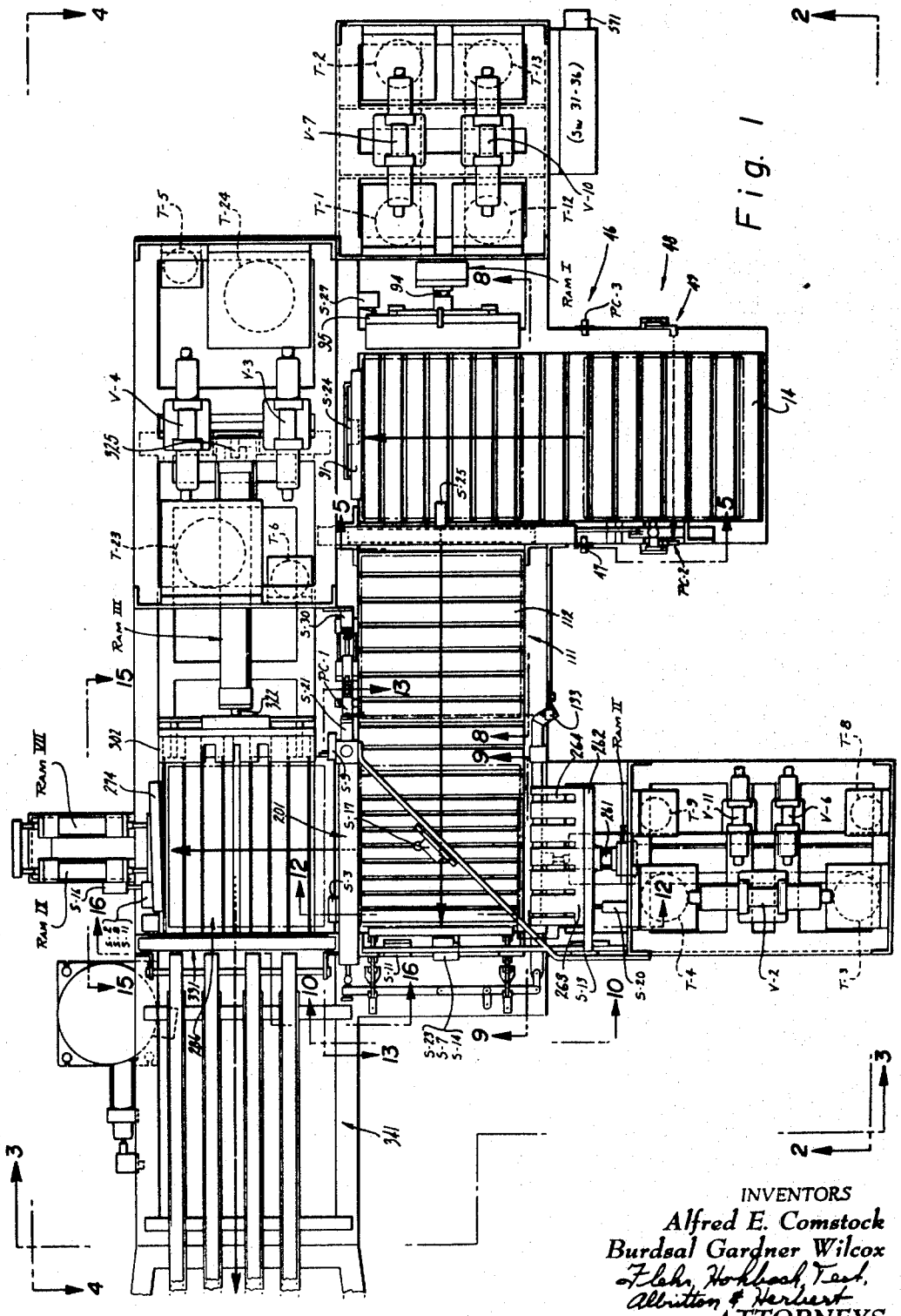
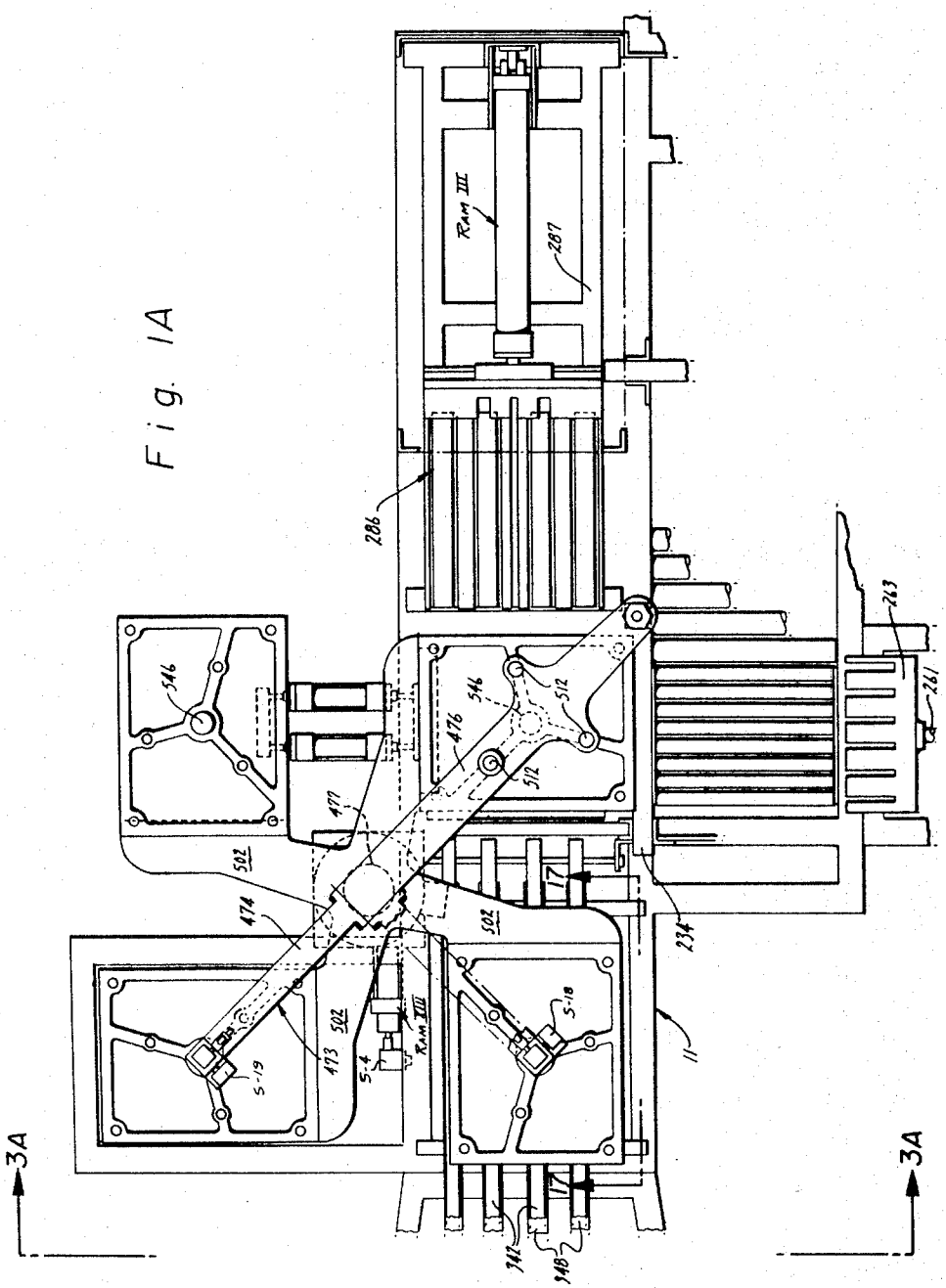


Fig. 1

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Fig. 1A



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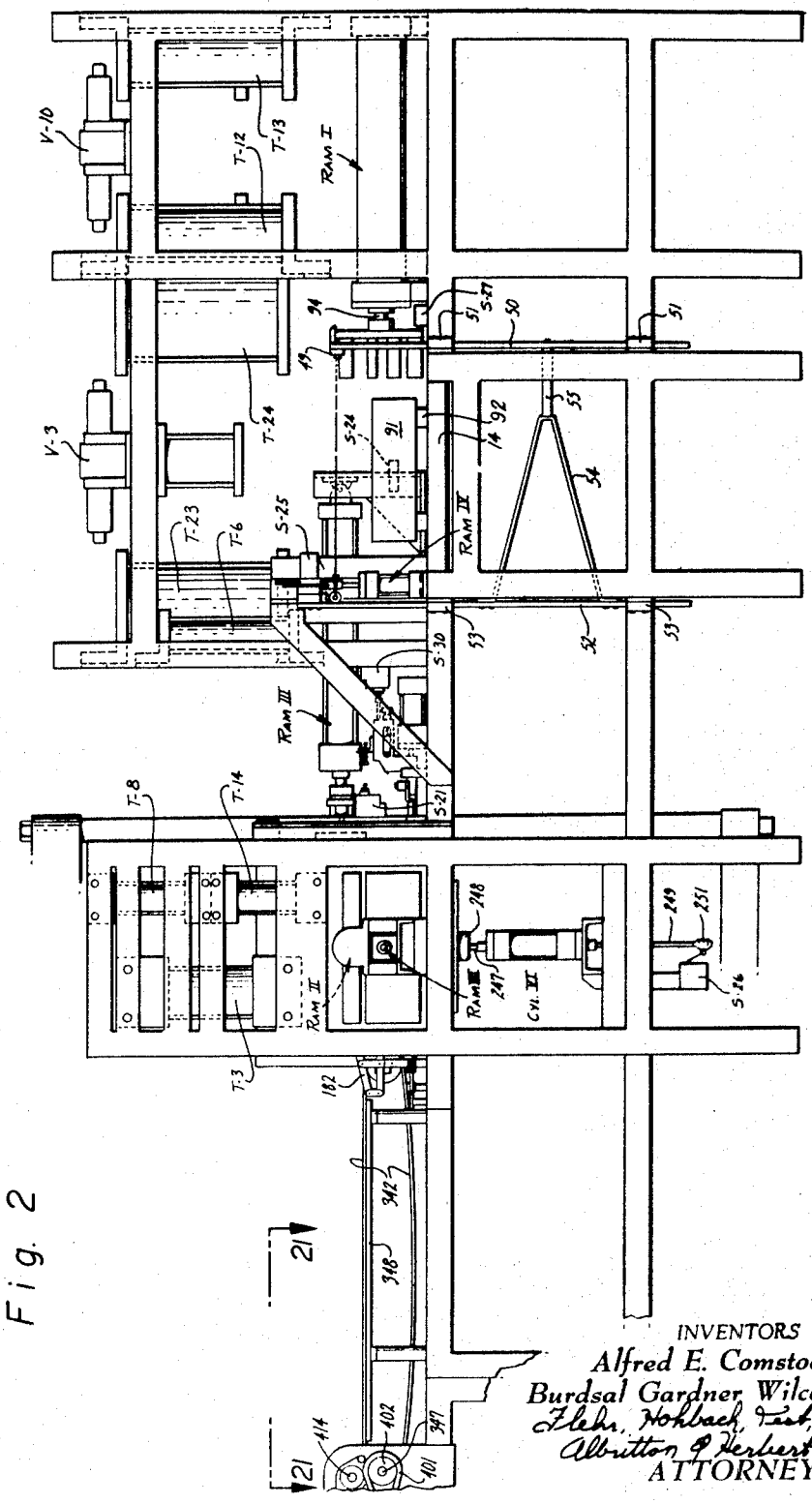


Fig. 2

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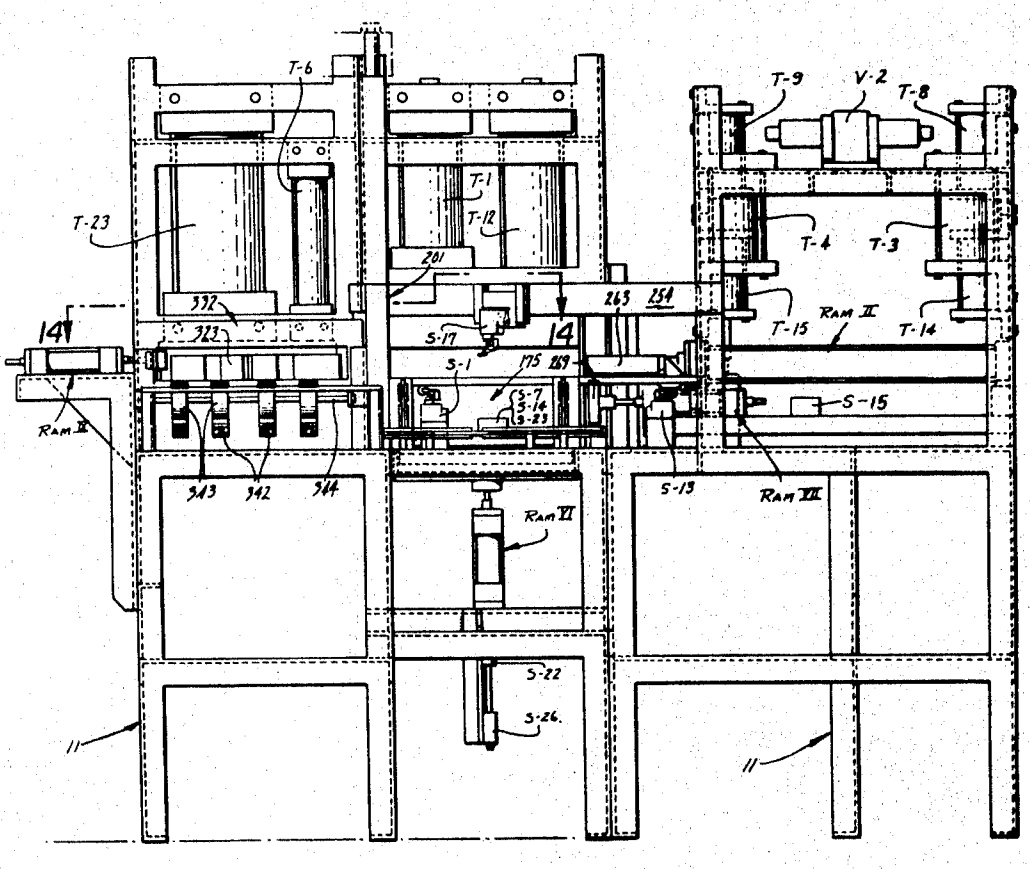
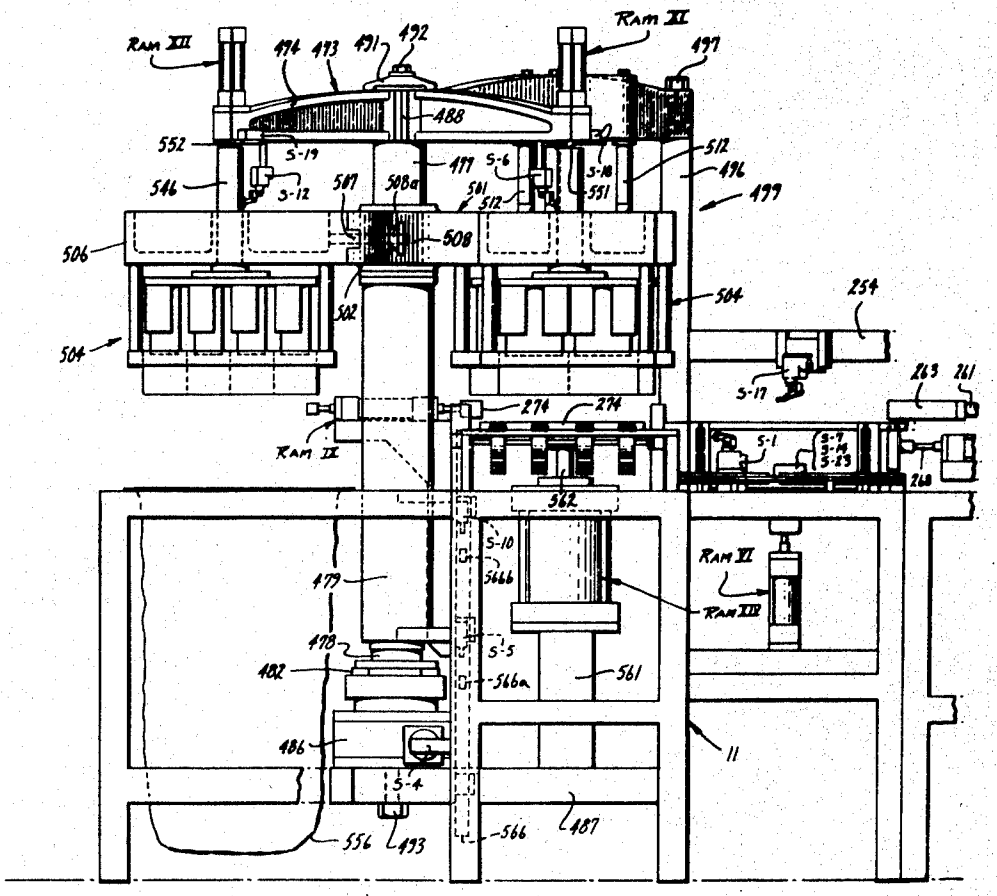


Fig. 3

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Fig. 3A



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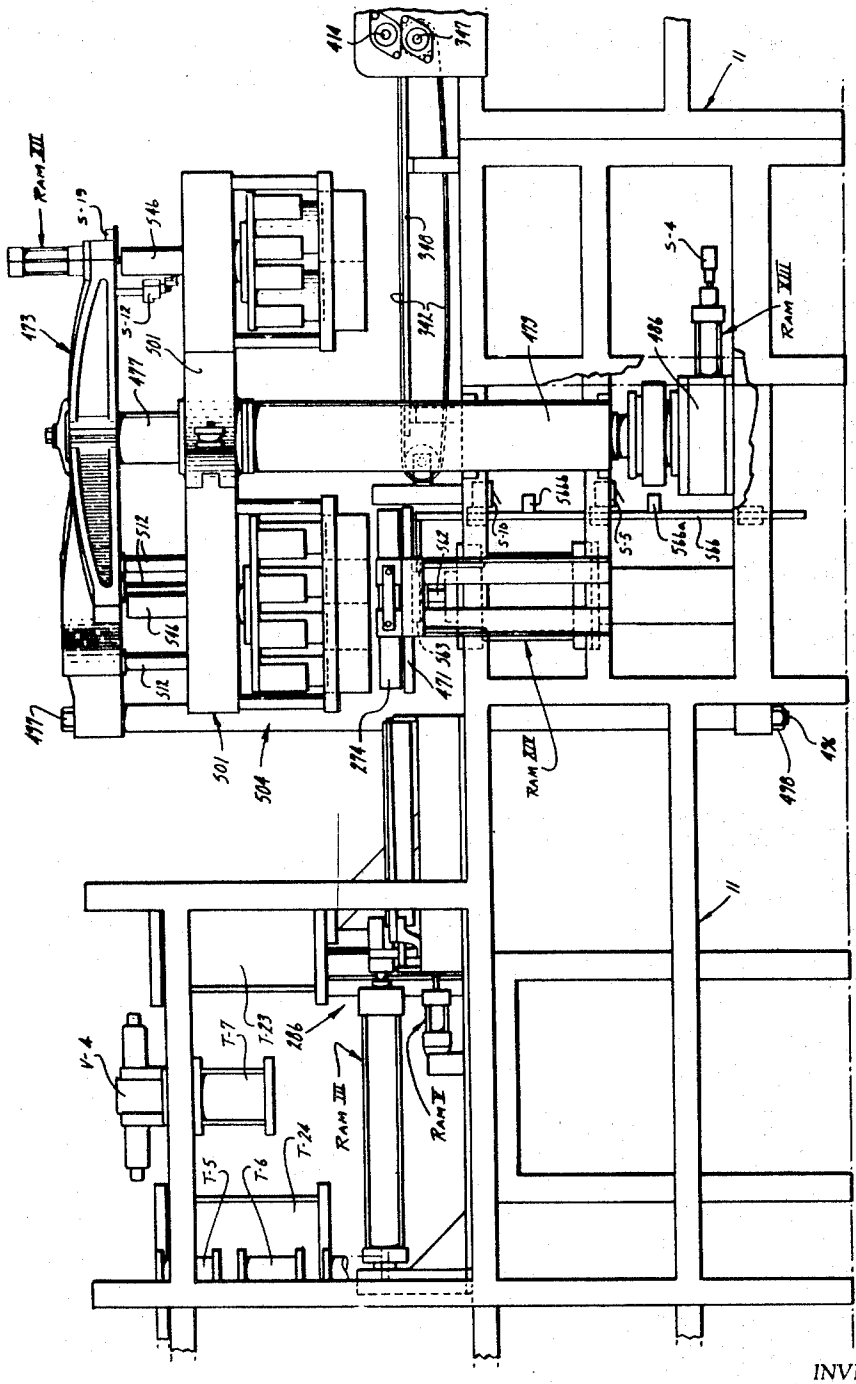


Fig. 4

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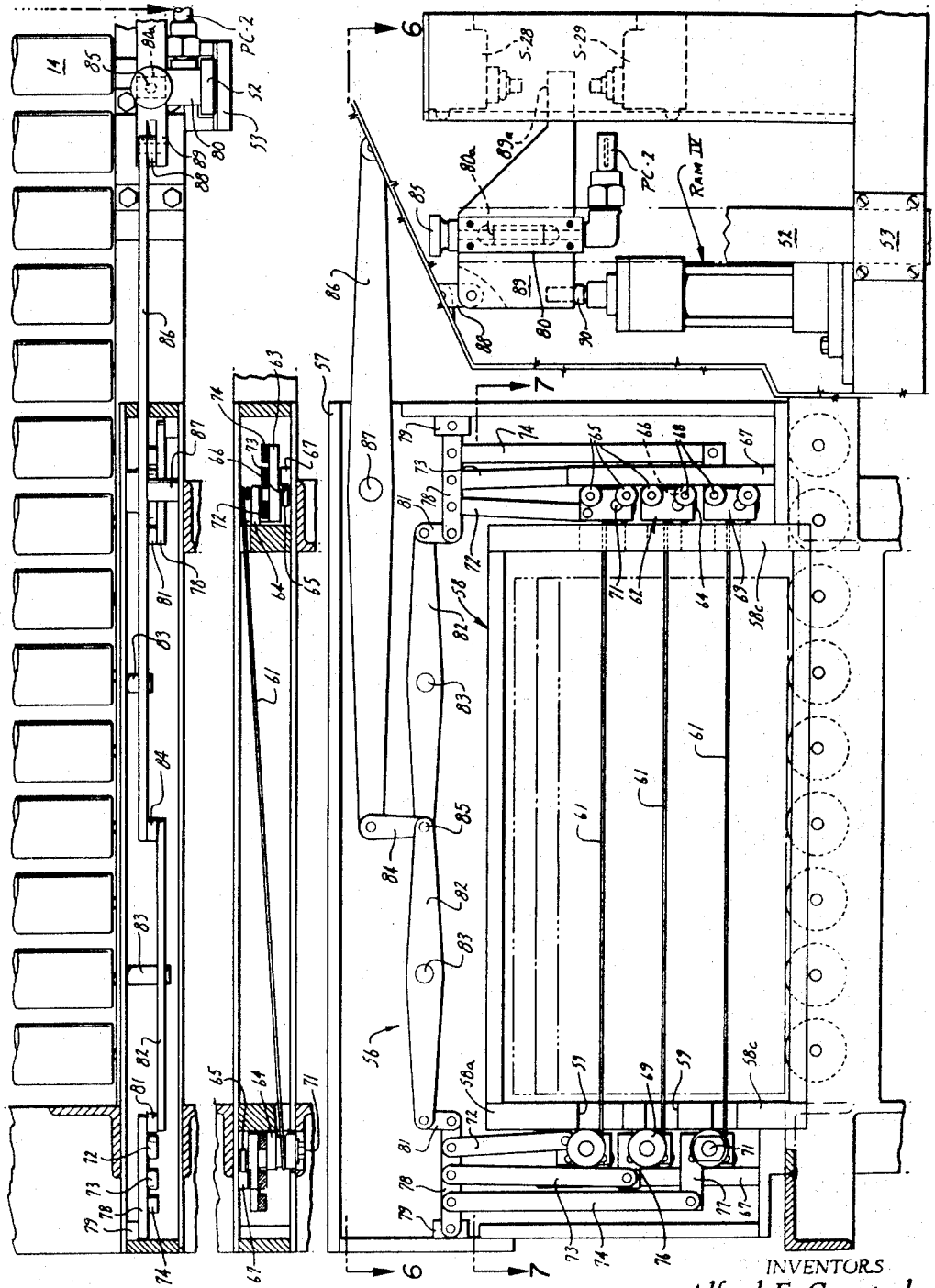


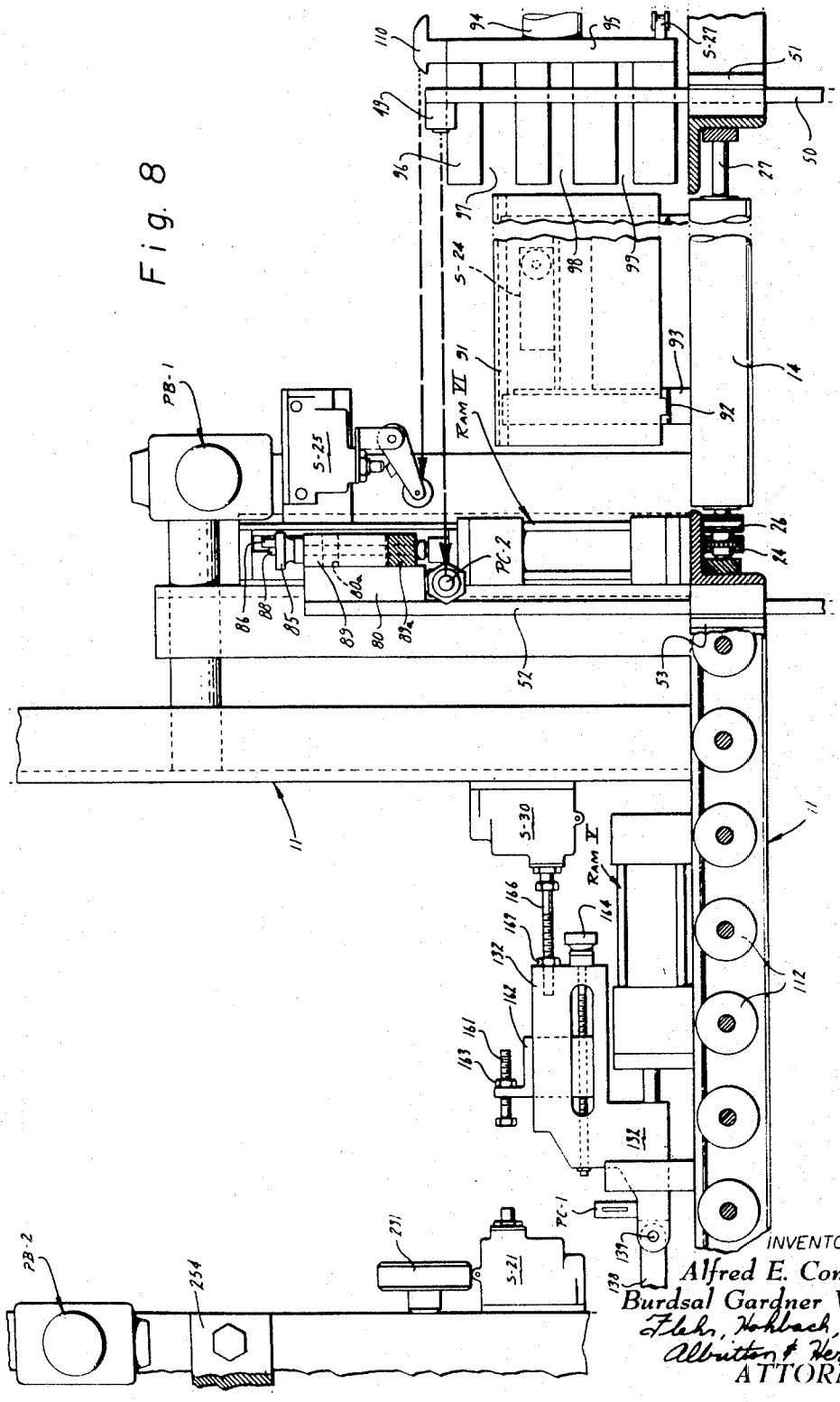
Fig. 6

Fig. 7

Fig. 5

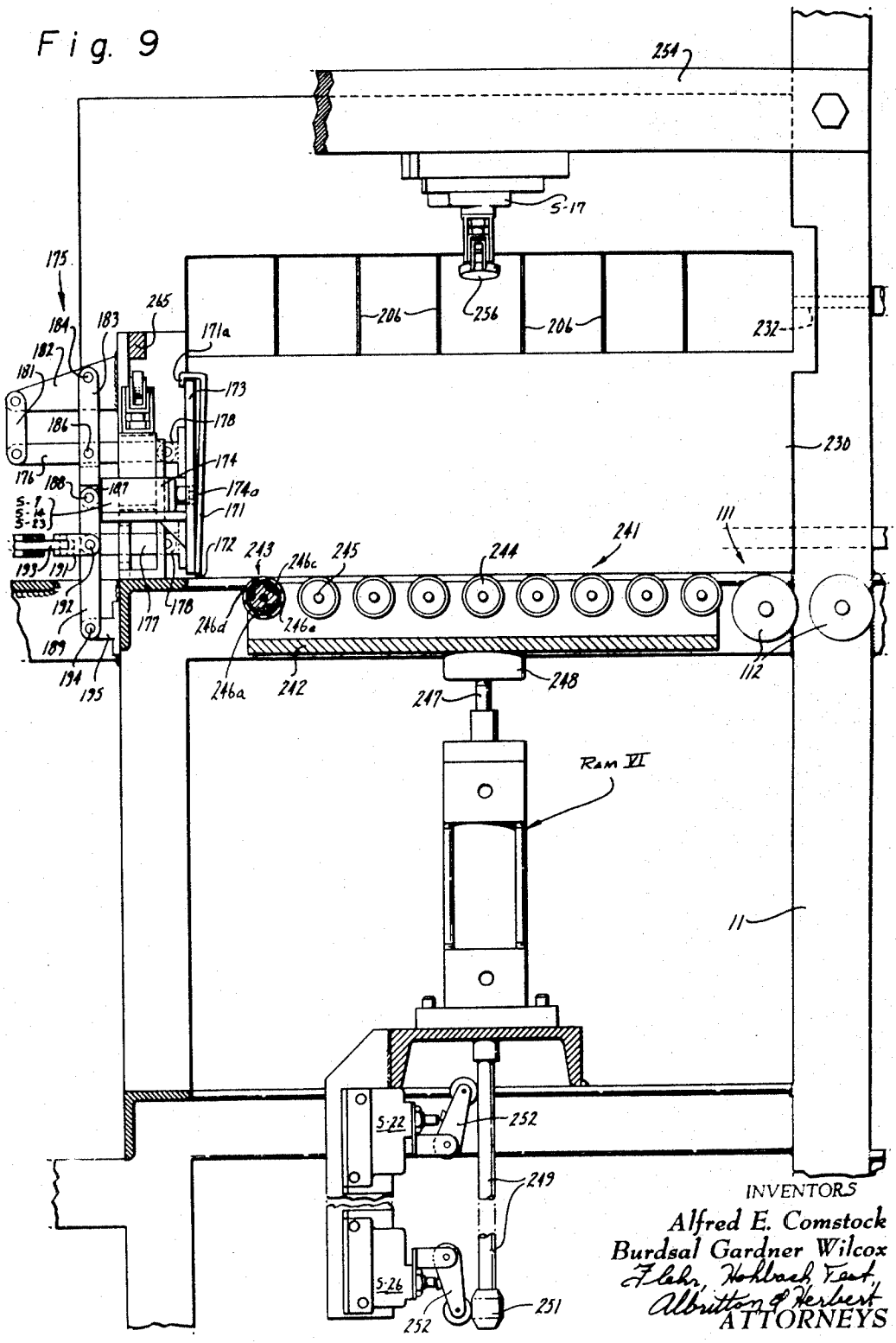
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Fig. 8



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Fig. 9



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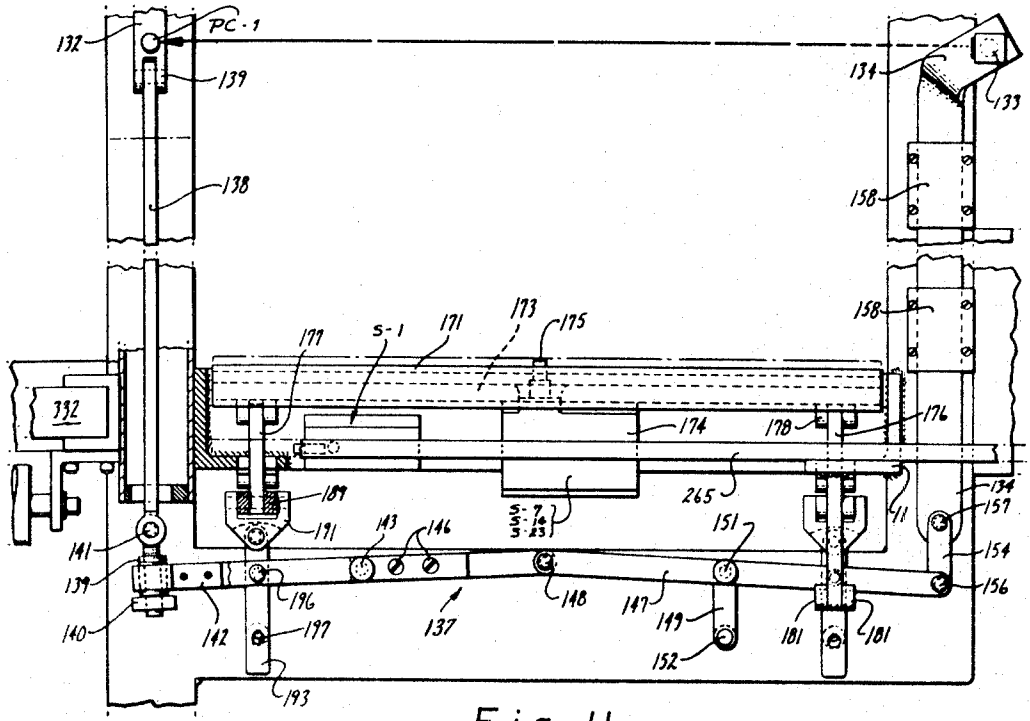


Fig. 11

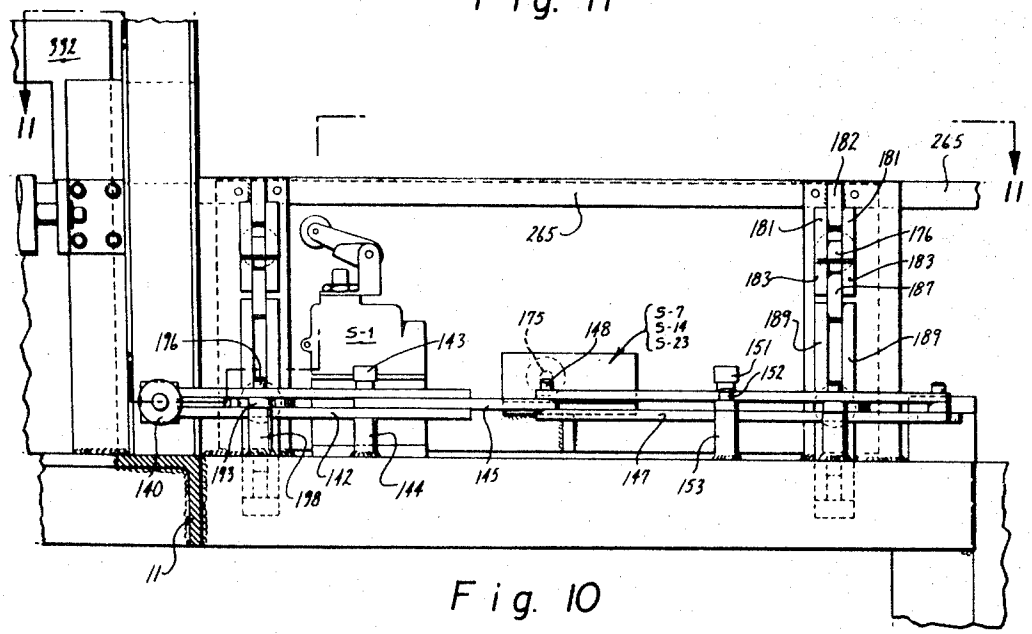


Fig. 10

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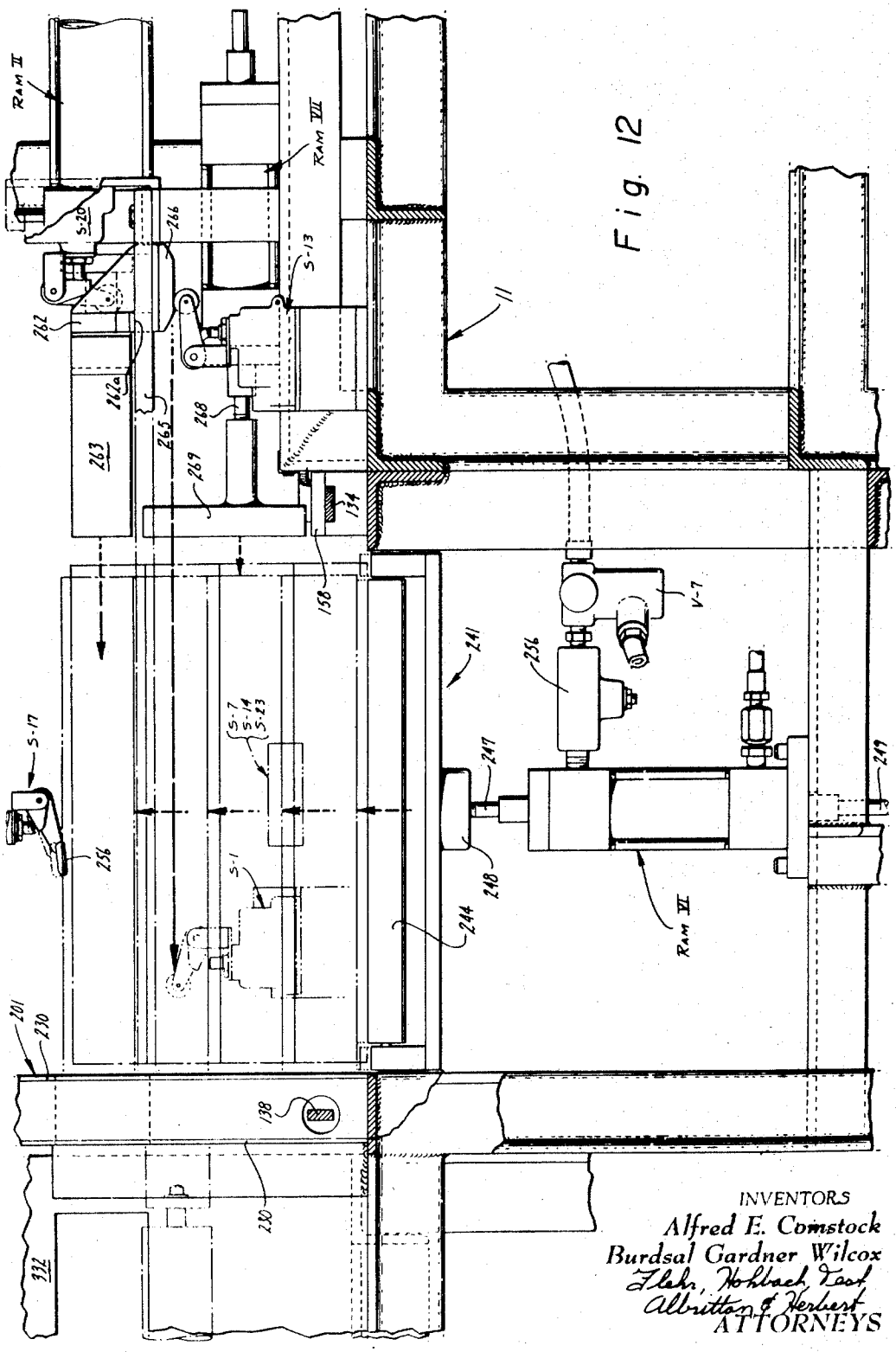


Fig. 12

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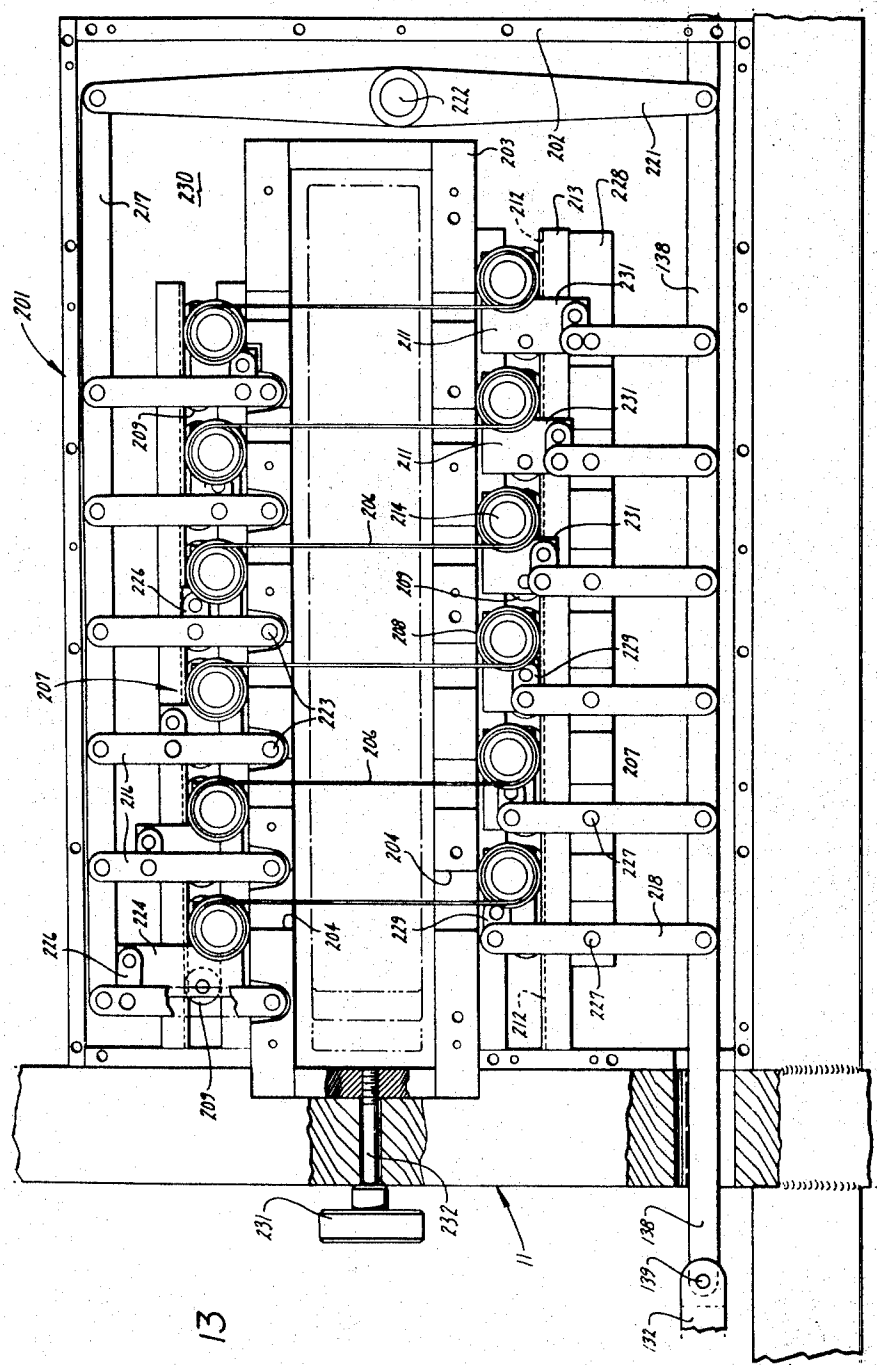
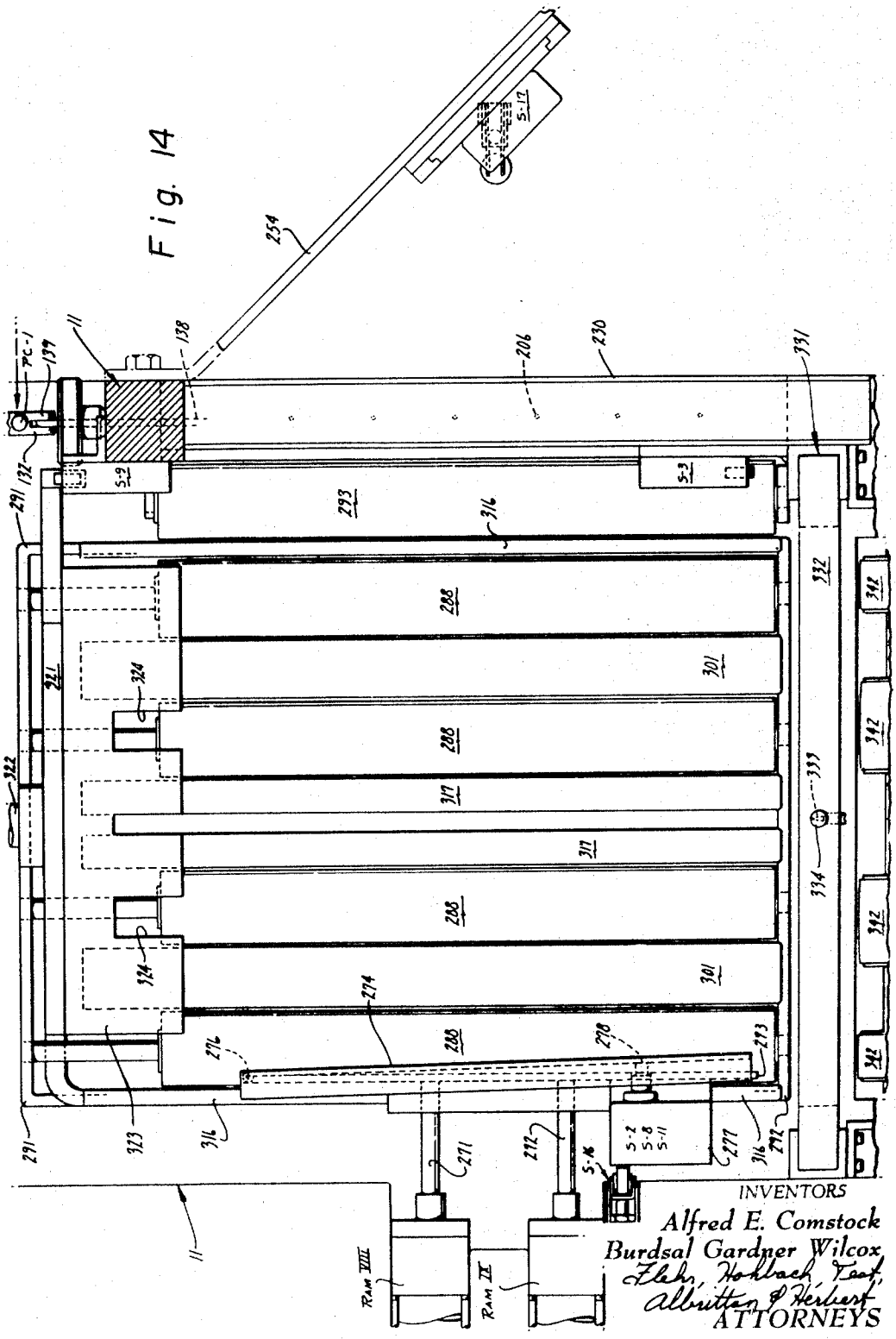


Fig. 13

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Fig. 14



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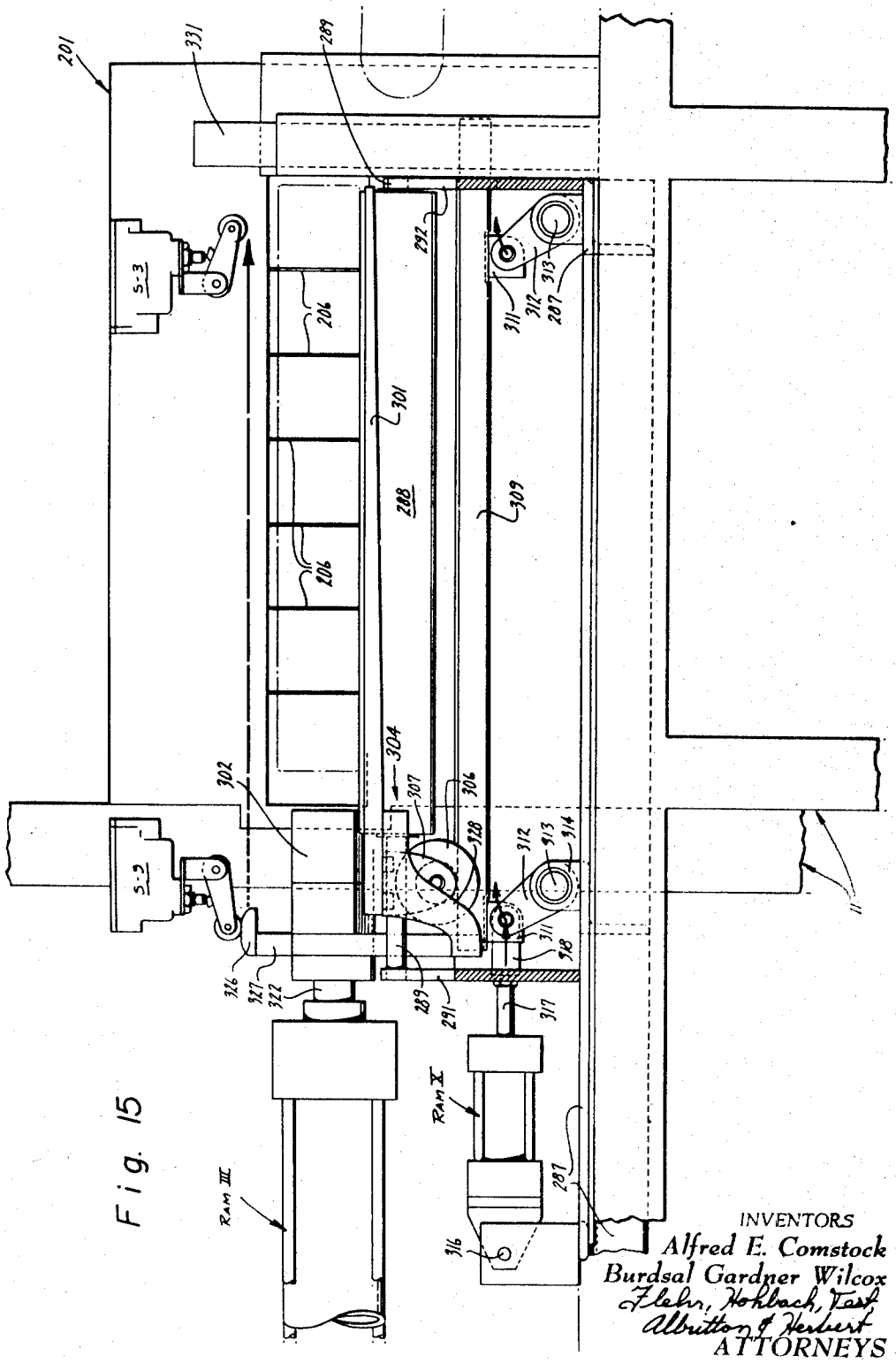


Fig. 15

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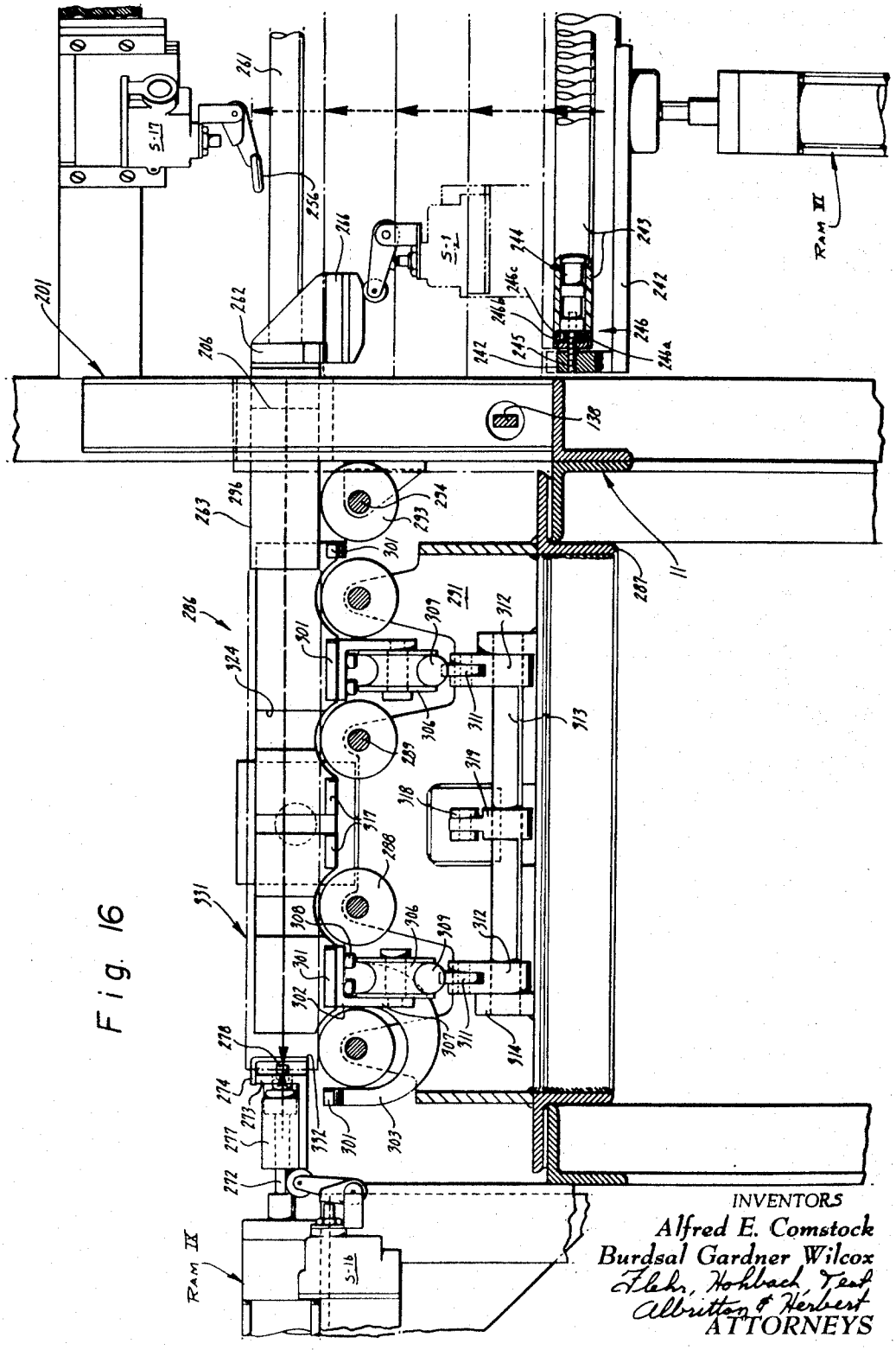


Fig. 16

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Fig. 18

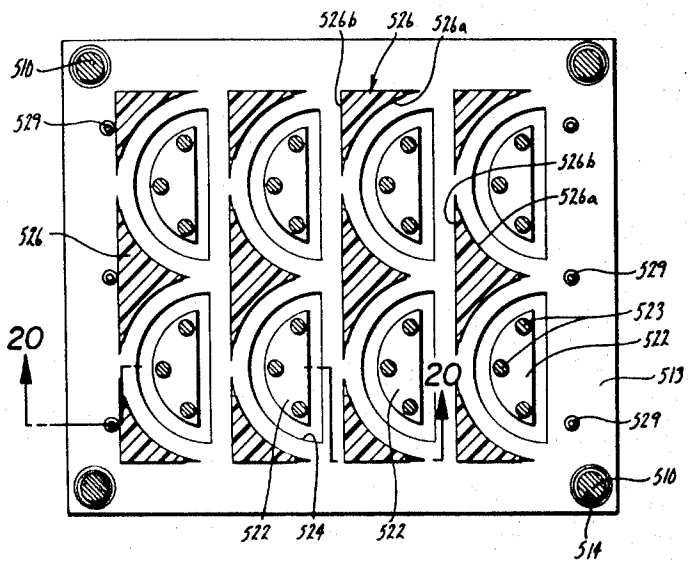
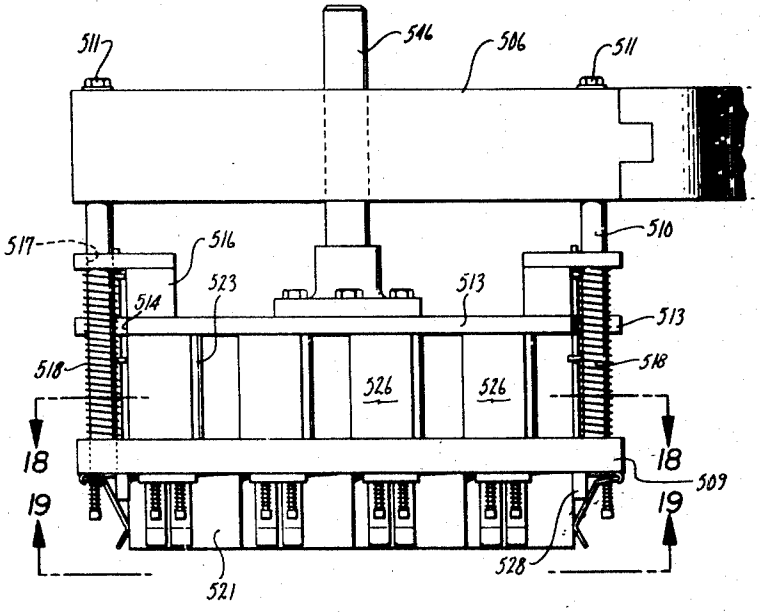
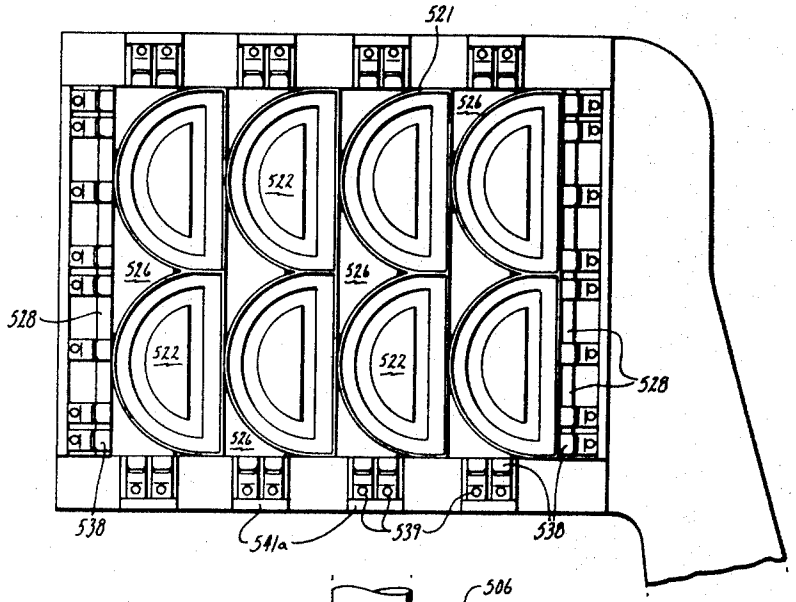


Fig. 17



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Fig. 19



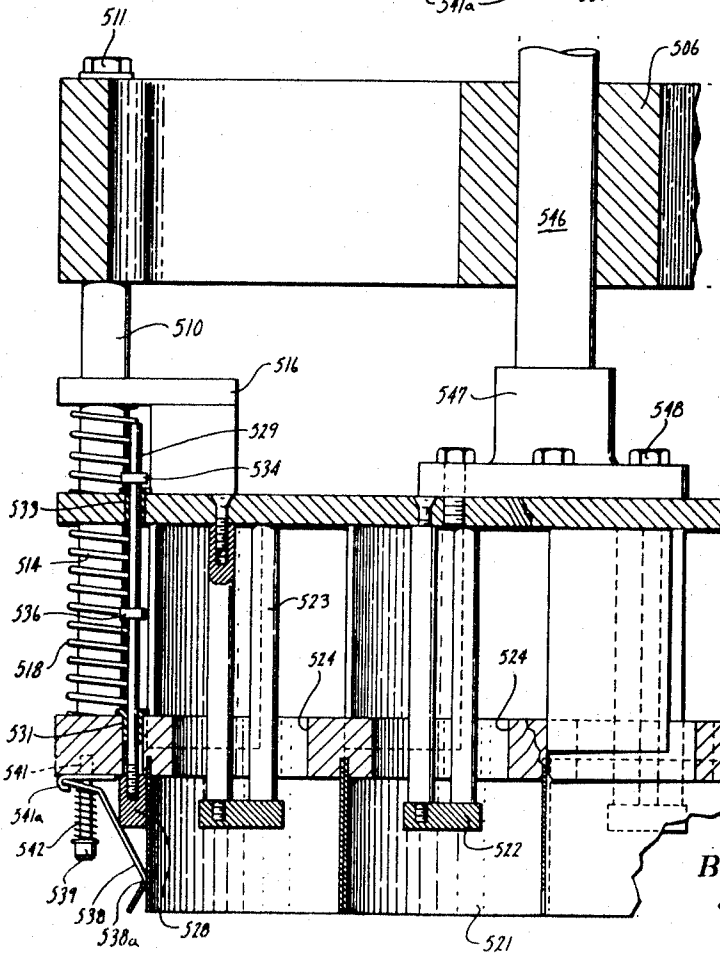


Fig. 20

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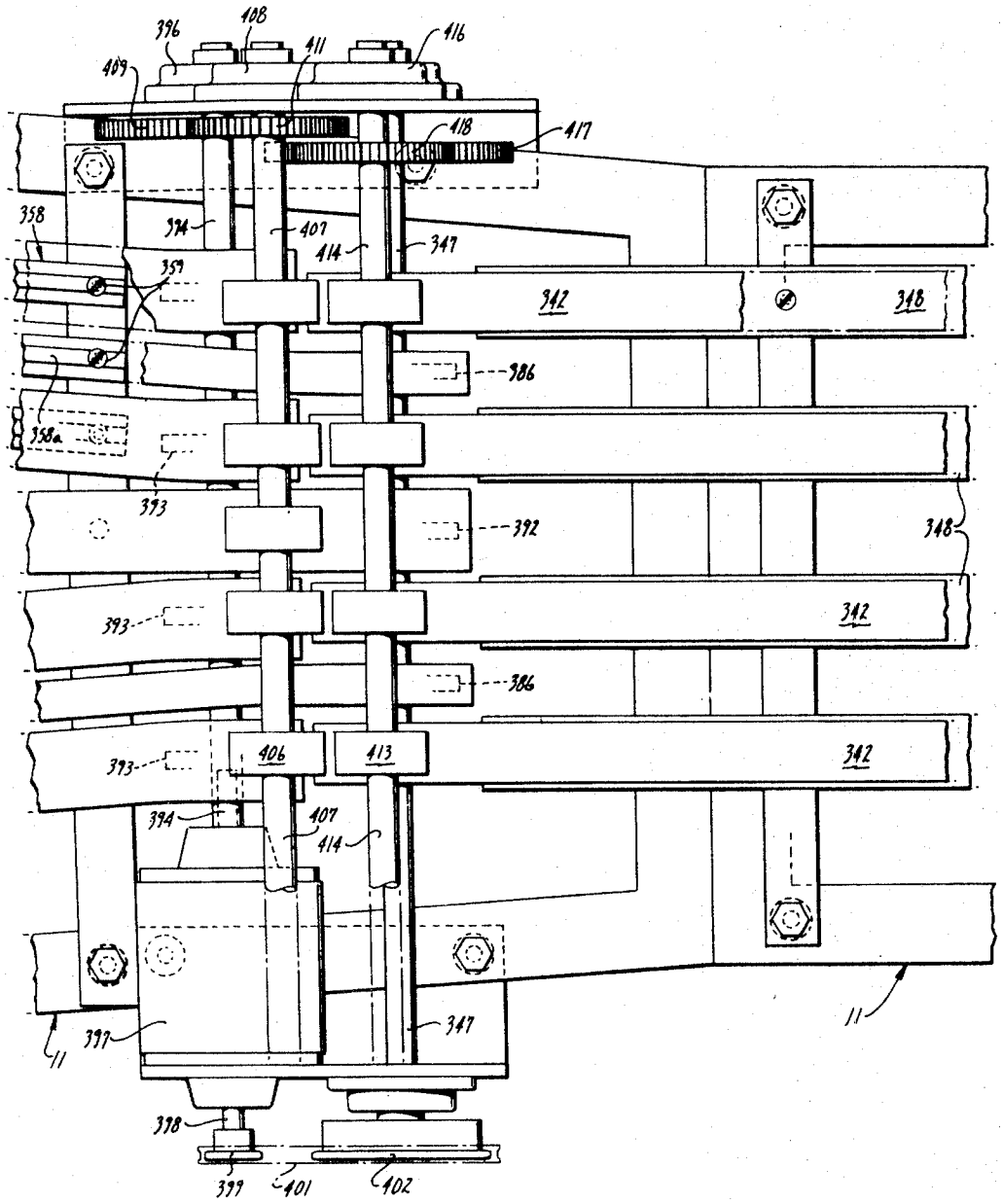
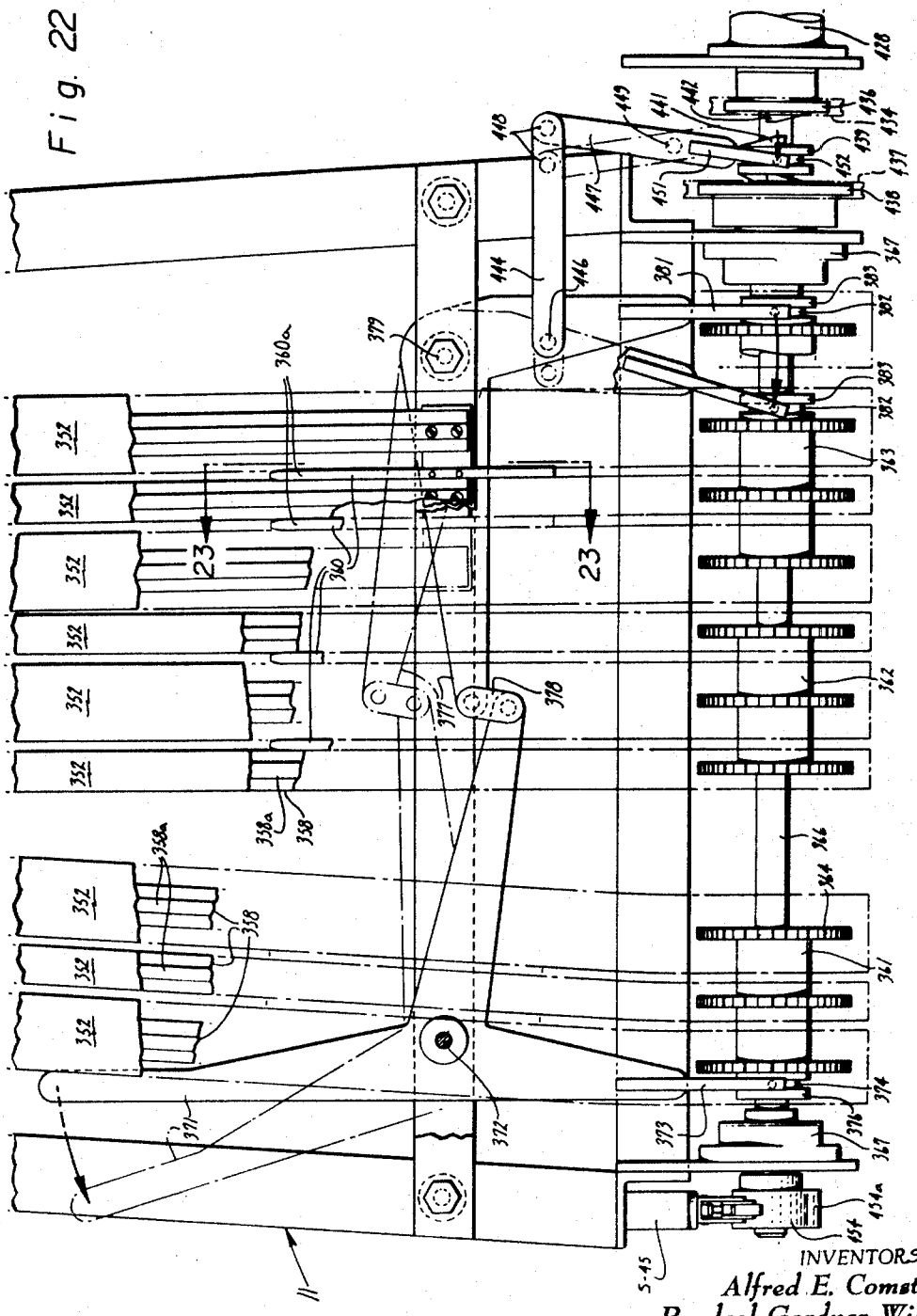


Fig. 21

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Fig. 22



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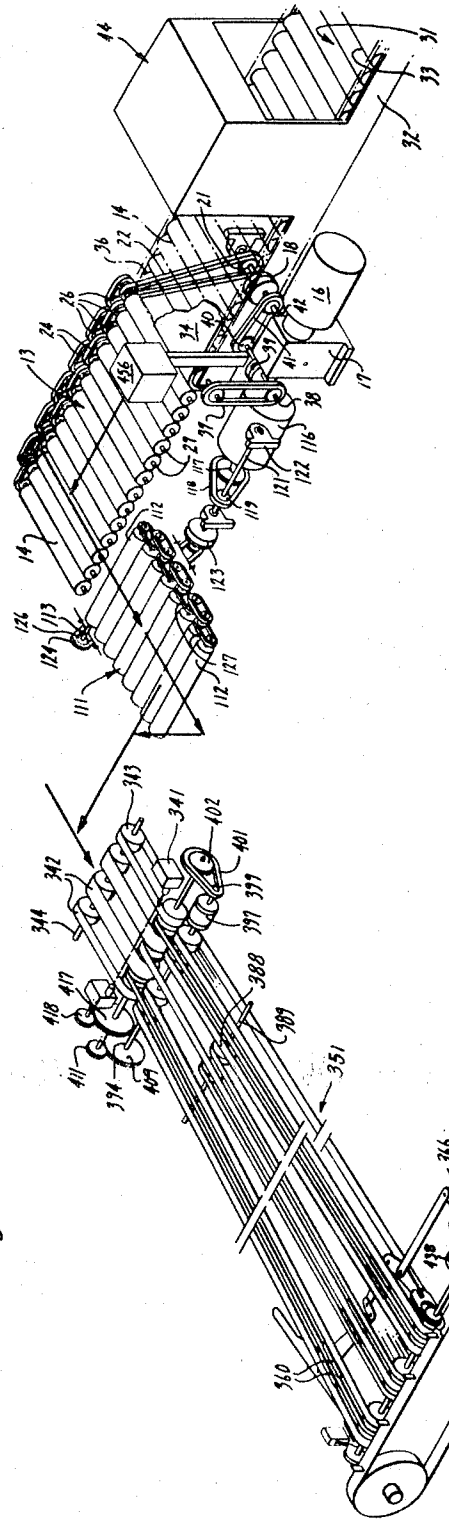


Fig. 24

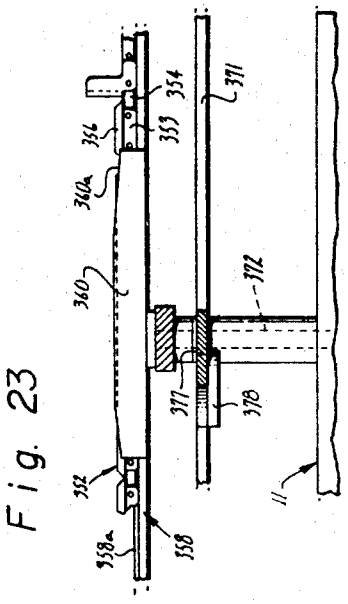


Fig. 23

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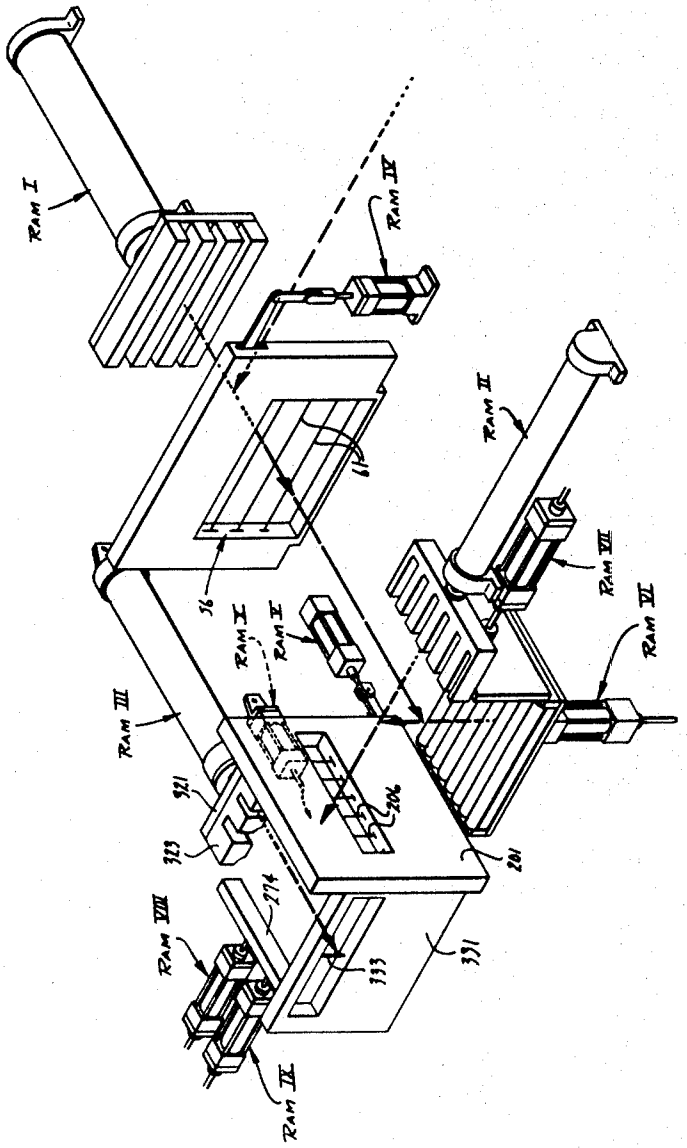
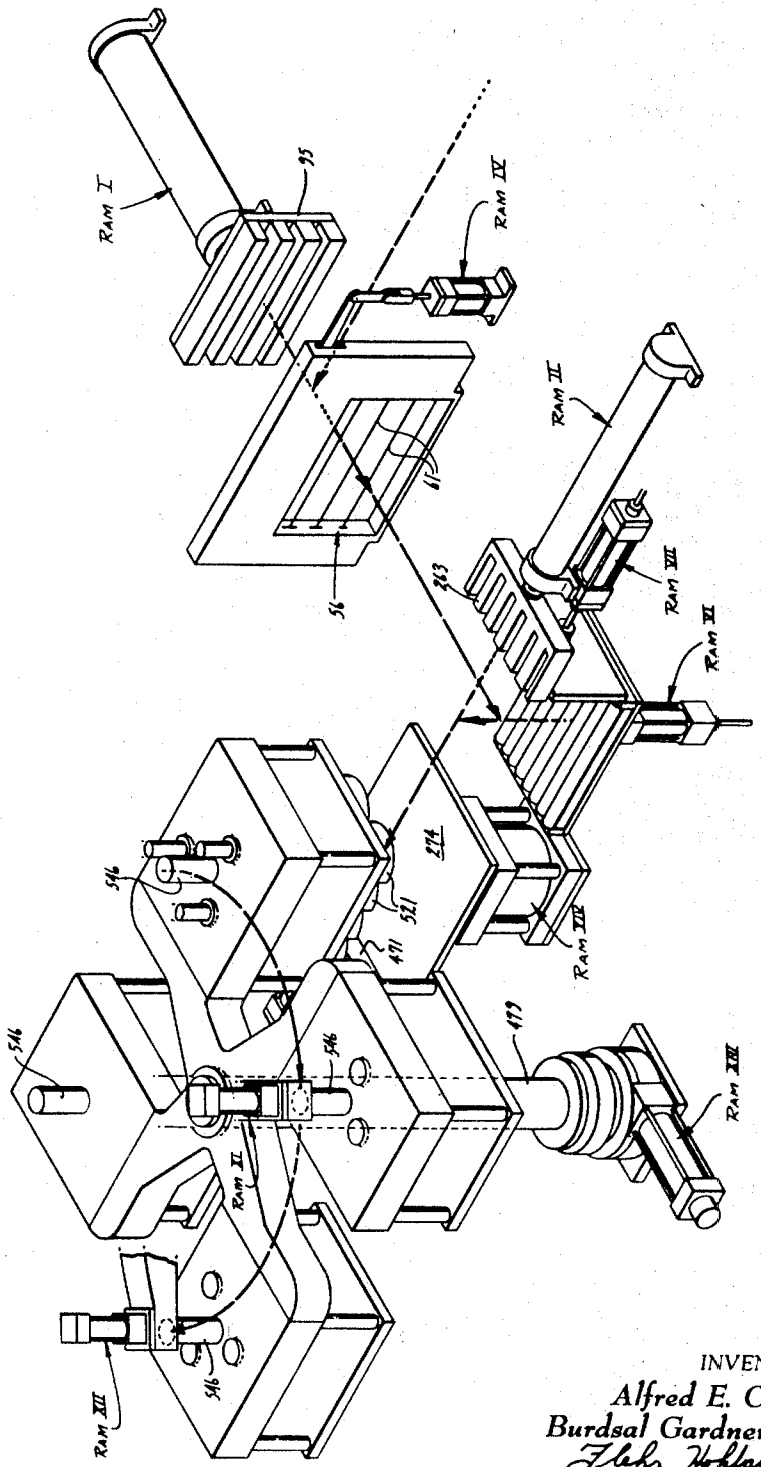


Fig. 25

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Fig. 25A



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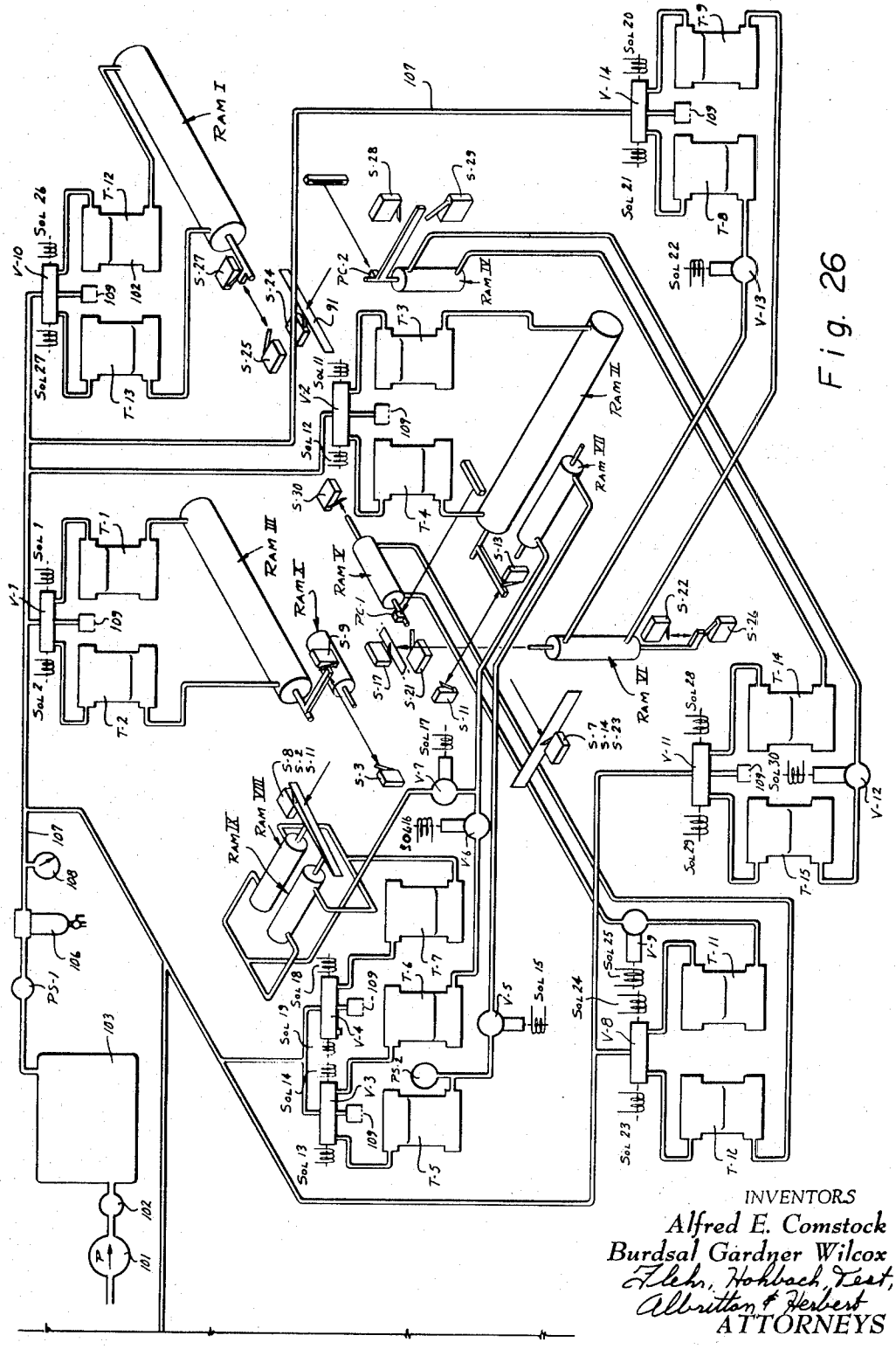


Fig. 26

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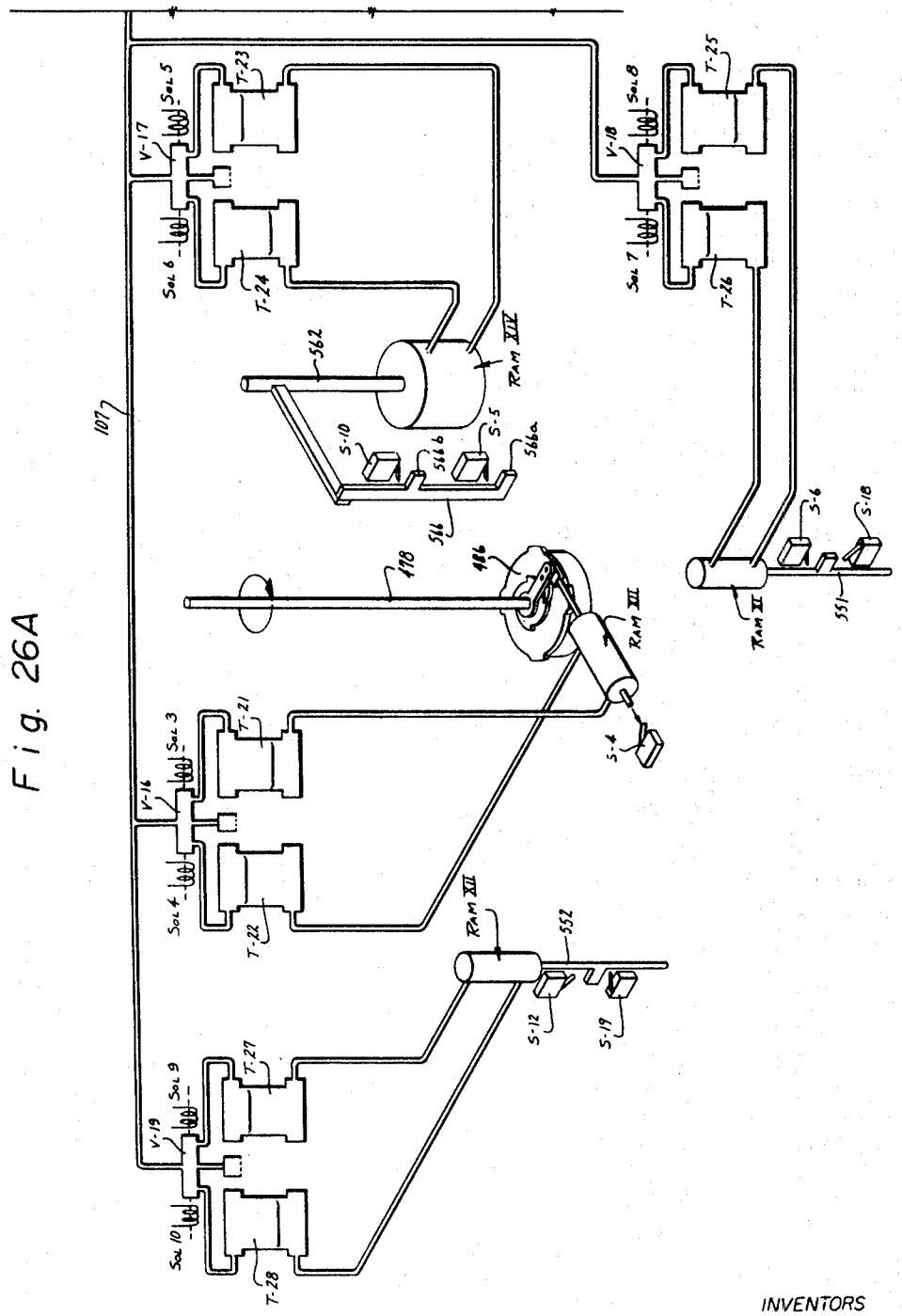


Fig. 26A

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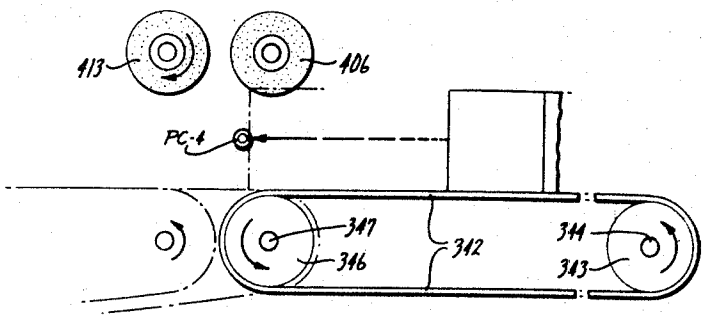


Fig. 27A

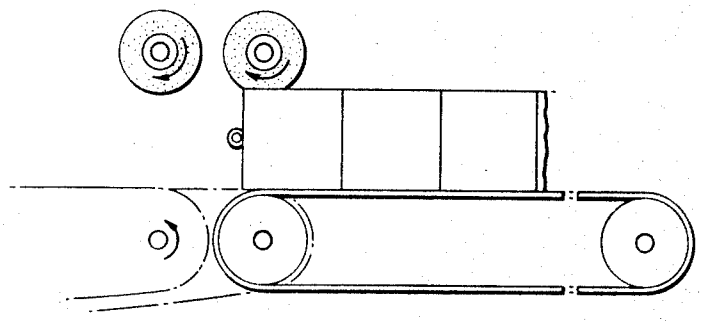


Fig. 27B

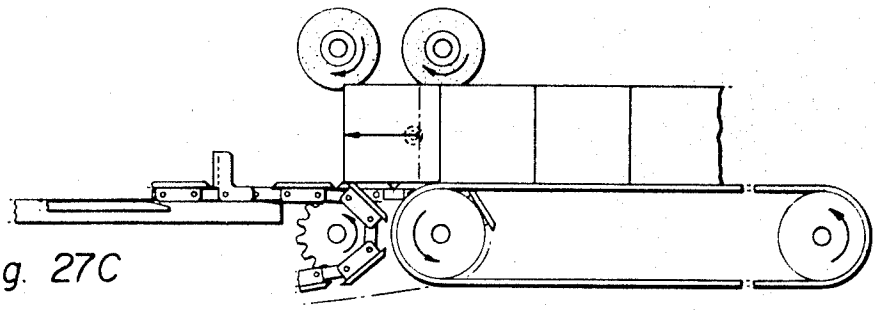


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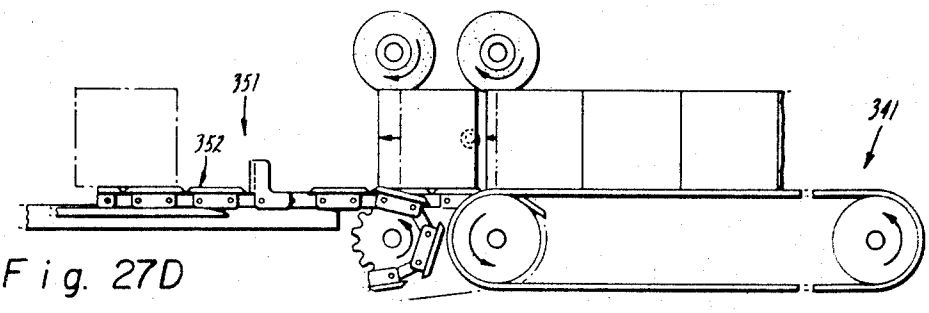


Fig. 27D

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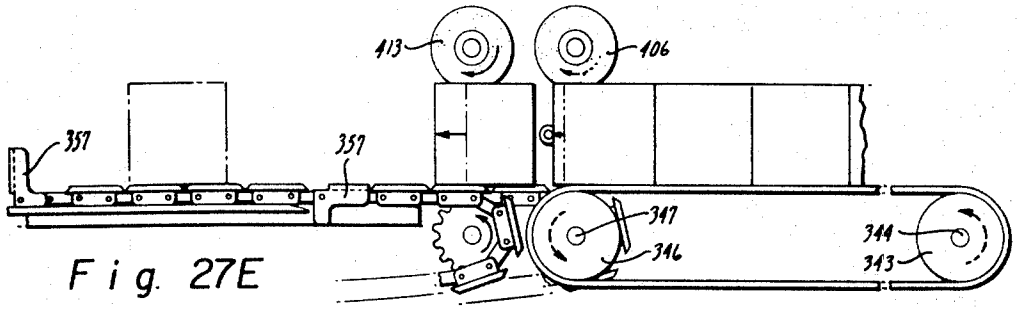


Fig. 27E

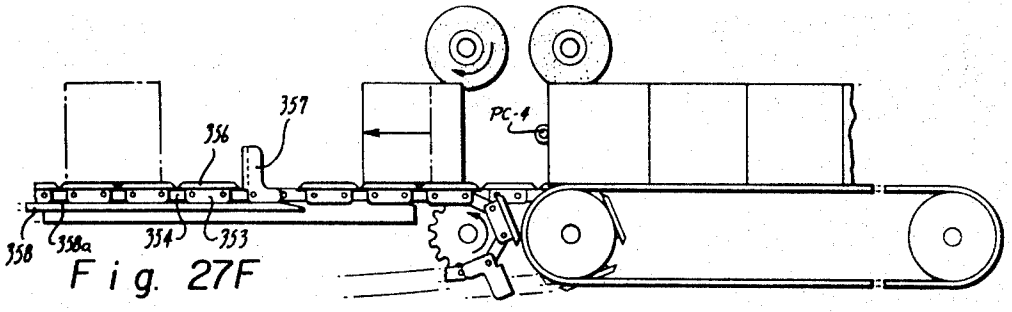


Fig. 27F

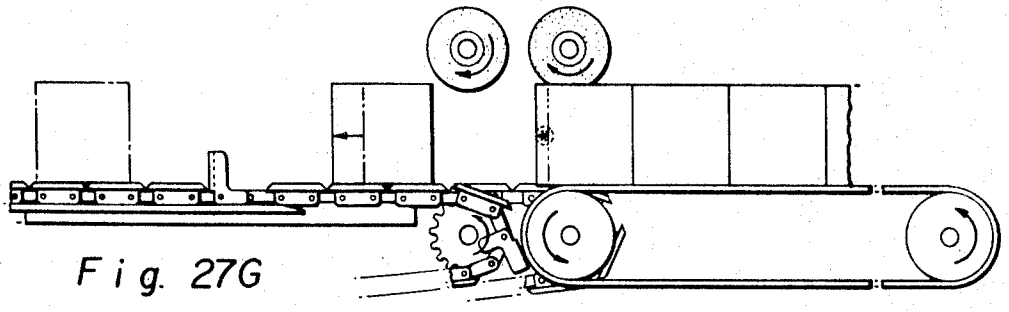
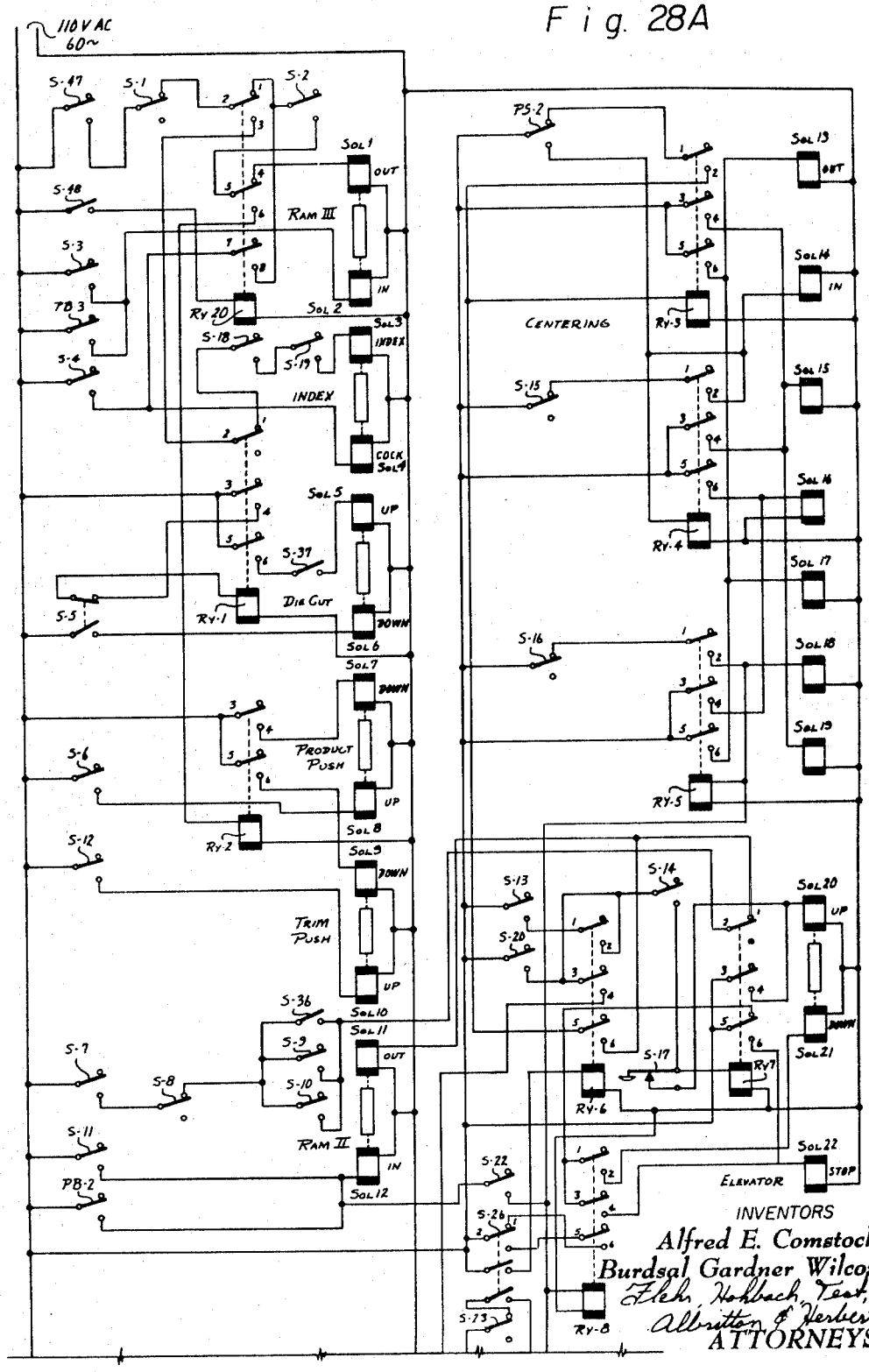


Fig. 27G

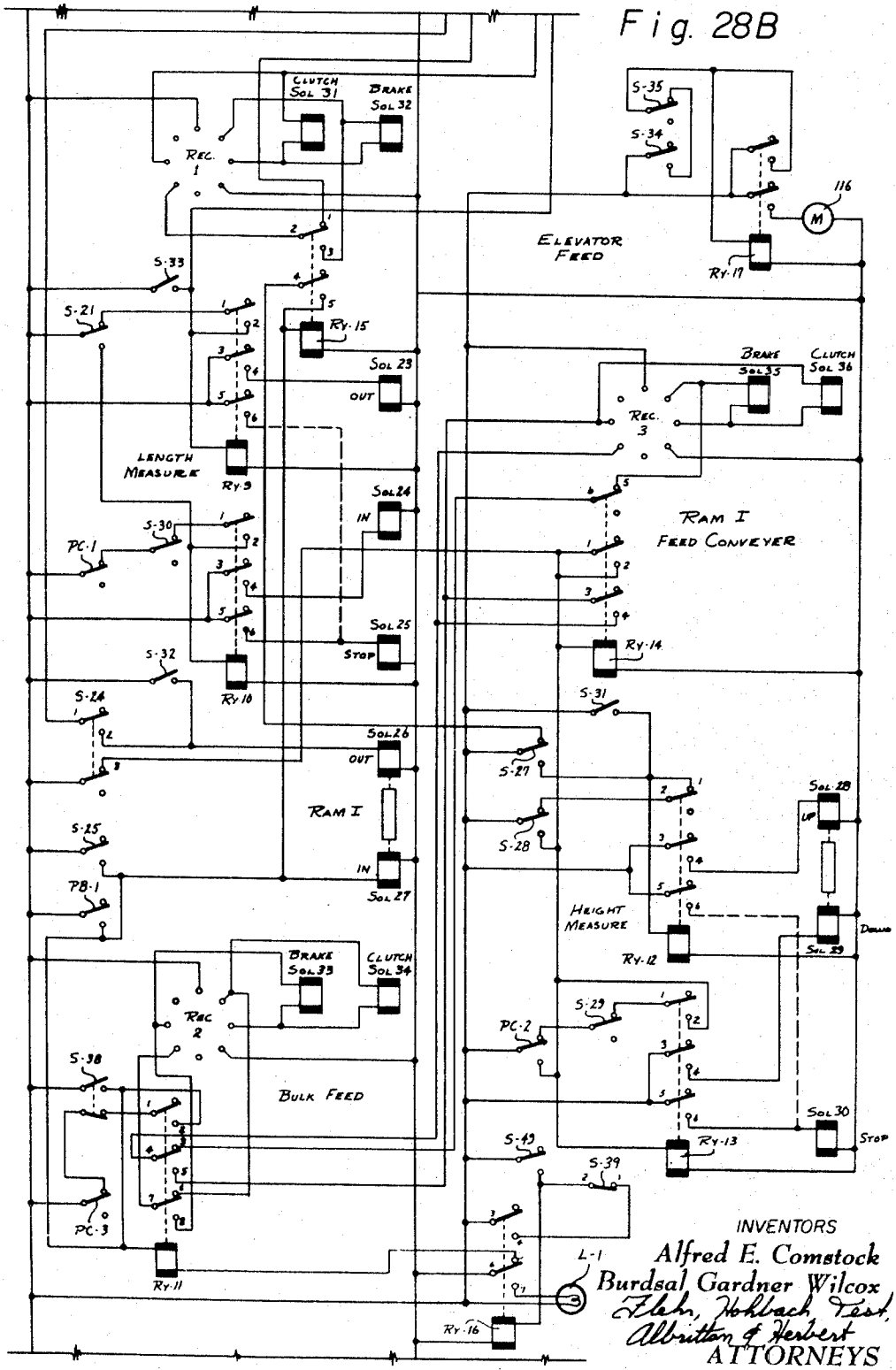
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Fig. 28A



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Fig. 28B



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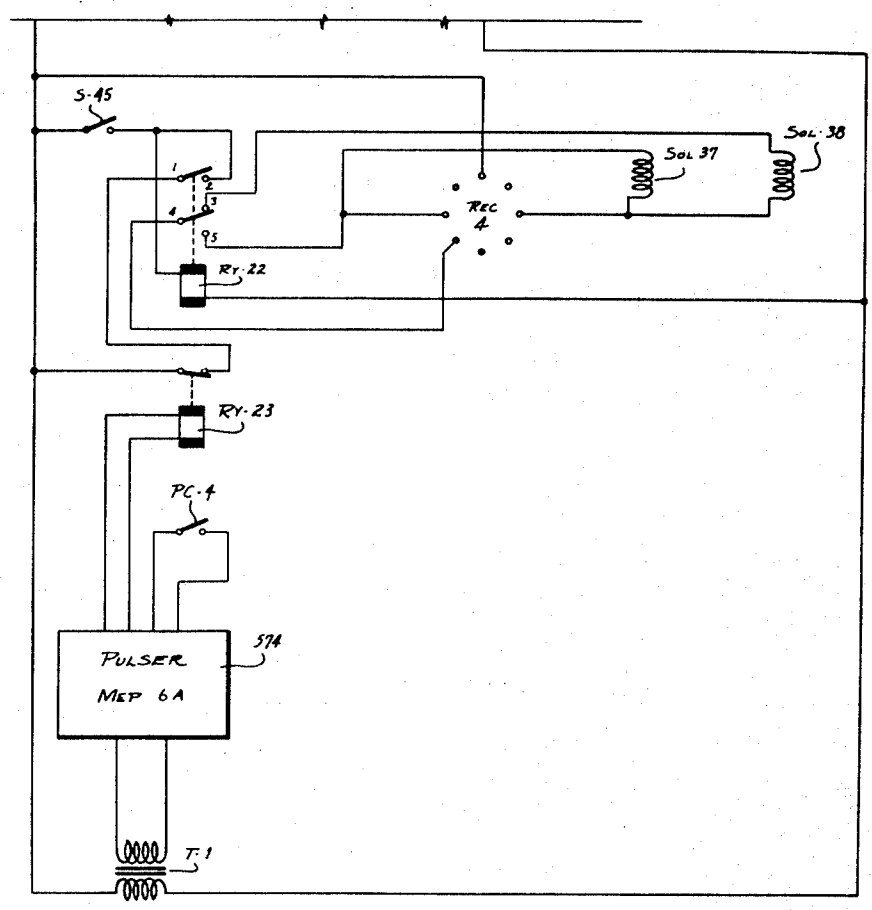
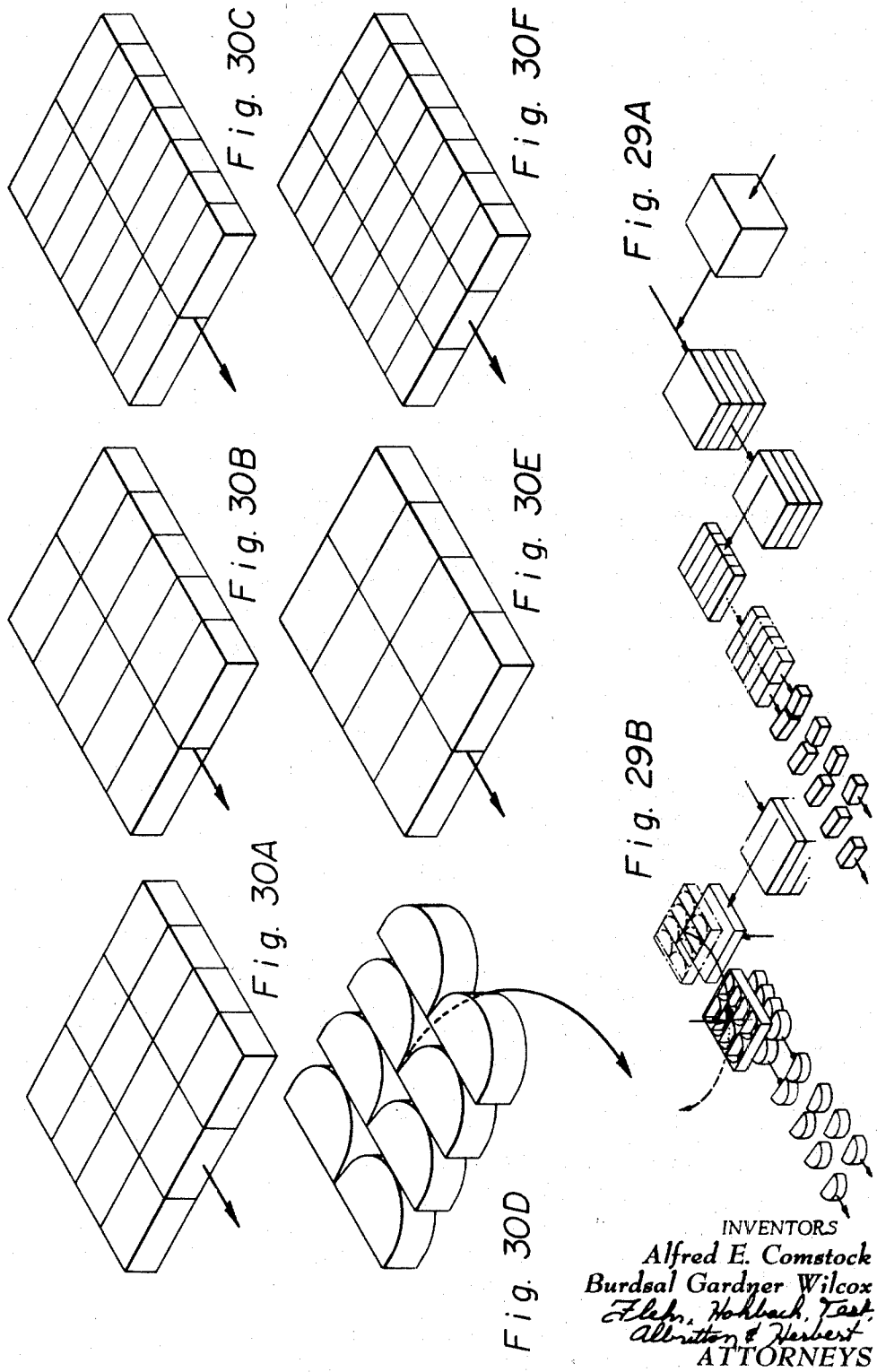


Fig. 28C

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APPARATUS FOR CUTTING AND HANDLING BLOCK-LINE ARTICLES

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of application Ser. No. 36,718 filed May 13, 1970, which is a division of application Ser. No. 780,009, filed Nov. 29, 1968, which in turn is a division of application Ser. No. 402,746 filed on Oct. 9, 1964.

BACKGROUND OF THE INVENTION AND OBJECTS

This invention relates to apparatus for cutting and handling articles and more particularly to apparatus for cutting large plastic blocks into smaller blocks and delivering the blocks to an automatic wrapping machine.

It has long been a practice in the packaging industry to seal perishable articles and particularly food products such as cheese, sliced meats and the like within a wrapping of impervious sheet material by the use of automatic packaging machines. However, at the present time, in order to feed such automatic packaging machines, it is necessary to use a great deal of hand labor in order to prepare the articles so that they can be handled by the wrapping machine. This is particularly true of cheese where it is necessary to cut large blocks of cheese primarily by a plurality of hand operations into small blocks and to then feed these small blocks to the automatic packaging machinery. There is, therefore, a need for apparatus for the cutting and handling of articles which can be utilized for delivering articles to automatic wrapping machines.

In general, it is an object of the present invention to provide apparatus for cutting and handling articles which can be utilitzed for supplying articles to an automatic wrapping machine.

Another object of the invention is to provide apparatus of the above character which can be utilized with large blocks of various sizes.

Another object of the invention is to provide apparatus of the above character in which the large blocks are cut into smaller blocks of various sizes.

Another object of the invention is to provide apparatus of the above character in which waste is reduced to a minimum.

Another object of the invention is to provide apparatus of the above character in which the size of the smaller blocks is adjusted in accordance with the size of the large blocks.

Another object of the invention is to provide apparatus of the above character which can be utilitzed for producing either half-round or rectangular blocks.

Another object of the invention is to provide apparatus of the above character which is completely automatic.

Another object of the invention is to provide apparatus of the above character which is controlled by the automatic wrapping machine.

Another object of the invention is to provide apparatus of the above character in which the large blocks are centered before cutting to minimize waste.

Another object of the invention is to provide apparatus of the above character in which the height and length of the large blocks are measured to facilitate cutting of the blocks to minimize waste.

Another object of the invention is to provide apparatus of the above character in which various combinations of cuts can be obtained.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of apparatus for cutting and handling articles incorporating the present invention with a substantial portion of the apparatus utilized for die cutting removed.

FIG. 1A is a view similar to FIG. 1 with the die cutting apparatus in place.

FIG. 2 is a front elevational view of the apparatus shown in FIG. 1 taken along lines 2—2 of FIG. 1.

FIG. 3 is a side elevational view of the apparatus shown in FIG. 1 looking along the line 3—3 of FIG. 1.

FIG. 3A is a side elevational view similar to FIG. 3 looking along the line 3A—3A of FIG. 1A.

FIG. 4 is a rear elevational view of the apparatus shown in FIG. 1 looking along the line 4—4 of FIG. 1.

FIG. 5 is an enlarged cross-sectional view taken along the line 5—5 of FIG. 1.

FIG. 6 is an enlarged cross-sectional view taken along the line 6—6 of FIG. 5.

FIG. 7 is an enlarged cross-sectional view taken along the line 7—7 of FIG. 5.

FIG. 8 is an enlarged cross-sectional view taken along the line 8—8 of FIG. 1.

FIG. 9 is an enlarged cross-sectional view taken along the line 9—9 of FIG. 1.

FIG. 10 is an enlarged cross-sectional view looking along the line 10—10 of FIG. 1.

FIG. 11 is an enlarged cross-sectional view taken along the line 11—11 of FIG. 10.

FIG. 12 is an enlarged cross-sectional view taken along the line 12—12 of FIG. 1.

FIG. 13 is an enlarged cross-sectional view taken along the line 13—13 of FIG. 1.

FIG. 14 is an enlarged cross-sectional view taken along the line 14—14 of FIG. 3.

FIG. 15 is an enlarged cross-sectional view taken along the line 15—15 of FIG. 1.

FIG. 16 is an enlarged cross-sectional view taken along the line 16—16 of FIG. 1.

FIG. 17 is a cross-sectional view taken along the line 17—17 of FIG. 1A.

FIG. 18 is an enlarged cross-sectional view taken along the line 18—18 of FIG. 17.

FIG. 19 is an enlarged view looking along the line 19—19 of FIG. 17.

FIG. 20 is an enlarged fragmentary cross-sectional view taken along the line 20—20 of FIG. 18.

FIG. 21 is an enlarged top plan view looking along the line 21—21 of FIG. 2.

FIG. 22 is an enlarged top plan view of a portion of the delivery conveyor which is shown schematically in FIG. 24.

FIG. 23 is an enlarged cross-sectional view taken along the line 23—23 of FIG. 22.

FIG. 24 is an isometric diagram, partially schematic, showing the drive mechanism for the apparatus.

FIG. 25 is an isometric view of major portions of the apparatus shown as being used for cutting large plastic blocks into smaller units.

FIG. 25A is an isometric view schematically illustrating major portions of the apparatus when utilized for a die cutting operation.

FIG. 26 is a schematic diagram of the piping for the apparatus when used for block cutting.

FIG. 26A is a schematic fluid diagram of the apparatus when used for die cutting.

FIGS. 27A–27G are schematic views showing advance of small blocks by delivery conveyors to the wrapping machine.

FIGS. 28A, 28B and 28C are a circuit diagram for the apparatus with certain of the parts being schematically illustrated.

FIGS. 29A and 29B are schematic illustrations showing how a large block is cut into smaller units or blocks with the apparatus shown in FIGS. 1–27.

FIGS. 30A–30F show the number of combinations of cuts which can be obtained with the apparatus shown in FIGS. 1–27.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

More in particular, as shown in the drawings, the apparatus for cutting and handling articles consists of a main frame 11 which is formed of a suitable material, such as stainless steel, which lends itself to steam cleaning. As shown in the drawings, the main frame 11 is formed of a plurality of structural steel members to form a support for the various parts of the apparatus. The apparatus includes three principal rams which are identified as ram I, ram II and ram III, which are mounted upon the main frame 11.

Ram I Feed Conveyor 13

A ram I feed conveyor 13 is also mounted on the frame 11 and consists of a plurality of equally spaced parallel rollers 14 which lie in a horizontal plane and are rotatably mounted in the main frame 11. Each of the rollers is positively and independently driven from a motor 16 (see FIG. 24) through a speed reducer 17 and through an electrically operated clutch brake 18 of a conventional type such as one manufactured by the Warner Electric Company which includes brake and clutch solenoids SOL–35 and SOL–36 (see FIG. 28B). The output shaft of the clutch brake 18 drives a sprocket 21 which drives a chain 22. The chain 22 drives one of the rollers 14 which drives the succeeding rollers 14 through a plurality of chains 24. The chains 24 are mounted upon pairs of sprockets 26 mounted upon shafts 27.

Bulk Feed Conveyor 31

A bulk feed conveyor 31 is provided for supplying the large blocks or articles to the ram I feed conveyor 13. The bulk feed conveyor 31 can be of any suitable type such as shown in FIG. 24. As shown therein, it consists of a frame 32. A plurality of rollers 33 are rotatably mounted in the frame 32. A wide endless belt 34 is mounted on the rollers and is driven by a large roller or pulley 36. The roller 36 is driven from a chain 37 which is driven by a shaft 38. The shaft 38 is connected to a clutch brake unit 39 which is connected to a sprocket 40 driven by a chain 41. The chain 41 is driven by a sprocket 42 drive by the speed reducer 17.

A metal detector 44 is mounted over the bulk feed conveyor as shown in FIG. 24. This metal detector can be of any suitable type such as one manufactured by RCA. The belt 34 and the portion of the conveyor 31 immediately adjacent to the metal detector 44 is all formed on non-metallic materials. This includes the frame 32, the rollers 33, the means for mounting the rollers and the belt 34. Such a construction is of the type well known to those skilled in the art and is required to make the metal detector 44 so that it can detect small undesirable metal objects in the articles being carried by the bulk conveyor.

Initial Stop Means 46

Means 46 is provided for arresting the travel of or initially stopping the travel of the articles on the ram I feed conveyor 13 and consists of suitable means such as a photoelectric cell identified as PC–3 which is mounted on the main frame 11 on one side of the conveyor 13 and a source of light 47 mounted on the other side of the conveyor 13 on the main frame 11. As hereinafter explained, when the article carried by the conveyor 13 interrupts the beam of light from lamp 47 to the photoelectric cell PC–3, a signal is supplied to stop the conveyor 13.

Height Measuring Means 48

Height measuring means 48 is provided on the ram I feed conveyor 13 for measuring the height of an article which has been carried to a position in which it interrupts the beam from the lamp 47. This means consists of a lamp (not shown) mounted within a rectangular housing 49 which is mounted upon a support member 50 slidably mounted for vertical movement in brackets 51 secured to the main frame 11. As can be seen in FIG. 2, the housing 49 is mounted on one side of the conveyor 13. Photosensitive means in the form of photocell PC–2 is mounted on the other side of the conveyor 13 and movable with a support member 52 slidably mounted for vertical movement in brackets 53 secured to the main frame 11 as hereinafter described. The support member 52 is connected to the piston of a cylinder IV as hereinafter described so that it moves with the piston. Means is provided for interconnecting the support members 50 and 52 so they move in unison as cylinder IV is operated and consists of a V-shaped member 54 secured to the support member 52 and a post 55 which is connected to the V-shaped member 54 and the support member 50.

Horizontal Cutting Means 56

Horizontal cutting means 56, which forms a first cutting means, is mounted on the framework 11 in front of ram I and is adjusted by the height measuring means 48. The horizontal cutting means consists of an outer rectangular frame 57 and an inner rectangular frame 58, which are mounted upon the main frame 11 in front of the ram I. Spaced horizontal holes 59 are provided in the opposite vertical members 58*a* of the inner frame 58. Spaced parallel horizontal cutting elements in the form of wires 61 extend across the inner frame 58 and through the openings 59 and have their ends secured to small carriages 62 which are adapted to travel vertically on the inner frame 58. The carriages 62 include means for tensioning the wires 61 so that they will be very taut.

Each of the carriages 62 consists of a block 63. A roller 64 is rotatably mounted on the block and engages the vertical members 58*a* of the inner frame 58. Each of the carriages also includes a pair of small rollers 65 mounted on the other side of the block 63 and which travel in vertical grooves 66 provided in vertical bars 67 mounted upon the outer frame 57. Means is pro-

vided in each of the carriages for securing one end of the wire thereto as shown in FIGS. 5 and 7. On the carriages 62 provided on the right-hand side as viewed in FIG. 5, the wire 61 is secured to a pin 68 mounted upon the block 63. On the left-hand side, the wire is connected to a roll 69. This roll 69 is adapted to be rotated to a position so that the wire is taut and then secured in the desired angular position on the block 63 by a bolt 71. It will be noted that although the wires 61 extend horizontally in a longitudinal direction across the inner frame 58, the wires 61 are inclined at an angle in a lateral direction with respect to the inner frame 58 by connecting one end of the wire 61 near the front portion of the inner frame and the other end of the wire near the rear portion of the inner frame to facilitate cutting of the blocks as hereinafter described.

Means is provided for adjusting the carriages 62 and the wires 61 carried thereby vertically of the frame 58 in response to movement of the ram IV and consists of a plurality of arms 72, 73 and 74 provided on each side of the inner frame 58 and secured to the three carriages 62 provided on each side of the inner frame 58. The lower end of the arm 72 is pivotally connected directly to the uppermost carriage 62 as viewed in FIG. 5, whereas the lower ends of the arms 73 and 74 are pivotally connected to additional arms 76 and 77 secured to the other two carriages 62. The upper ends of the arms 72, 73 and 74 are pivotally connected at spaced positions on arms 78. One end of each of the arms 78 is pivotally connected to a block 79 mounted on the outer frame 57. The other end of each of the arms 78 is pivotally connected to a link 81. The other end of the link 81 is pivotally connected to one end of an arm 82. The arm 82 is pivotally mounted on a pin 83 fixed to the outer frame 57. The other ends of the arms 82 are pivotally interconnected and are also connected to a link 84 by a pin 86*a*. The other end of the link 84 is pivotally connected to a long arm 86 which is pivotally mounted on a pin 87 mounted on the outer frame 57. The other end of the arm 86 is pivotally connected to a plate 89 provided on the piston rod 90 of the cylinder IV. The support member 52 is secured to a block 80 adjustably mounted for vertical movement in the plate 89 by a screw 85 threaded into an ear 80*a* provided on the block. The photocell PC–2 is mounted on the block 80. The plate 89 is provided with an elongate portion 89a which is adapted to operate switches 5-28 and 5-29 as hereinafter described.

From the arrangement shown in FIG. 5, it can be seen that as the plunger 90 of cylinder IV is raised, the inner end of the arm 86 will be pushed downwardly to push downwardly the inner ends of the arms 82. This will cause raising of the outer ends of the arms 82 about the pivots 83 which will cause the raising of the outer ends of the arms 78. Raising of the arms 78 will cause the arms 72, 73 and 74 and the associated carriages 62 secured thereto to also be raised. However, it will be noted that since the arms 72, 73 and 74 are secured at spaced points along the arms 78 that the carriages 62 secured thereto will be moved a distance proportional to the distance at which the arms 72, 73 and 74 are connected to each of the arms 78 measured from the point at which the arm 78 is connected to the link 81. Thus, the uppermost carriage 62 in FIG. 5 will be moved the greatest distance, whereas the lowermost carriage will be moved the least distance. Such an arrangement is particularly desirable for cutting as hereinafter described to eliminate waste.

Ram I

As hereinafter explained, after the article has been stopped by the photosensitive switch PC-3 and its height measured by the switch PC–2 and the horizontal cutting means 56 adjusted accordingly, means is actuated to again cause the ram I feed conveyor to be operated to advance the article thereon until it engages a stop plate 91 (FIGS. 1 and 2) which is hingedly mounted on posts 92 (FIG. 2) provided on the main frame 11. A microswitch S–24 is mounted on the frame 11 behind the stop plate 91 and is operated by the stop plate 91 when the article engages the stop plate to stop movement of the ram I feed conveyor 13 as hereinafter described. The stop plate 91 is positioned so that the article, when it is stopped, is properly positioned in front of the horizontal cutting means 56.

Means is provided for advancing the article after it has engaged the stop plate 91 to advance the same in a direction at right angles to the direction of advance by the conveyor 13 through the horizontal cutting means 56 and consists of a large ram, identified as ram I, which is mounted on the main frame 11 as shown particularly in FIG. 2. The ram I is provided with a plunger 94. A pusher plate 95 (see FIG. 1) is mounted on the plunger 94 and extends in a vertical plane. A plurality of spaced horizontal plates or bars 96 of a suitable material such as plastic are mounted upon the pusher plate 95 to provide three spaces 97, 98 and 99 which are arranged to receive the cutting wires 61 of the horizontal cutting means 56. The spaces 97, 98 and 99 are provided so that the wires 61 can enter therebetween and so that the ram can advance the front ends of the bars 96 past the wires so that the article being cut can be advanced completely through the cutting wires 61 without difficulty. The space 98 is wider than the space 99 to accommodate the greater range of vertical adjustment for the intermediate wire 61, whereas the upper space 97 is still wider to accommodate the still possible greater vertical adjustment of the upper cutting wire 61.

The ram I, as well as rams II and III, can be of any suitable type such as a double acting hydraulic cylinder manufactured by the S–P Manufacturing Corp. of Cleveland, Ohio. Suitable means is provided for operating ram I and consists of a pump 101 (see FIG. 26) which supplies compressed air through a valve 102 to a tank 103. Air from the tank 103 passes through a pressure switch PS–1 through a filter 106 to piping 107. A gauge 108 is provided for measuring the pressure of the air supplied to the piping 107. The piping 107 is connected through a valve V–10 to the upper portions of two tanks T–12 and T–13. As shown, the tanks T–12 and T–13 are partially filled with a suitable fluid such as hydraulic fluid. The valve V–10 is provided with solenoids SOL–26 and SOL–27 which control the flow of air through the piping 107 to the tanks T–12 and T–13. The valve V–10 or other similar valves used herein can be any suitable type such as ones manufactured by Numatics, Inc. of Highland, Mich.

When it is desired to advance the plunger 94 of ram I, it is merely necessary to cause air to be introduced into the top of the tank T–12 to cause hydraulic fluid to be forced therefrom into ram I to advance the plunger. Hydraulic fluid will then flow from the ram I

into the tank T–13 and air will be exhausted through the exhaust port 109 provided on the valve V–10. Conversely, when it is desired to return the ram I, solenoid SOL–27 is operated to cause air to be supplied to the tank T–13 to cause the hydraulic fluid to be supplied to the other side of the plunger 94 to cause it to be returned.

Switches S–25 and S–27 are provided for energizing the solenoids SOL–26 and SOL–29 as hereinafter described. The switch S–25 causes return of ram I and is mounted upon the outer frame 57 of the horizontal cutting means 56 as shown in FIGS. 1 and 2. The switch S–25 is adapted to be operated by an actuating member 110 carried by the pusher plate 95. Switch S–27 is mounted on the frame 11 and is engaged by the back plate 95 to indicate that ram I has returned to its home position (see FIGS. 2 and 8). A panic button PB–1 is mounted on the frame 11 near the region of travel of ram I (see FIG. 8) to cause emergency return of ram I.

Elevator Feed Conveyor 111

With the arrangement hereinbefore described, it can be seen that the article or block is cut into four separate superposed slices or slabs by the horizontal cutting means 56. These four slabs are advanced as a unit by the ram I onto an elevator feed conveyor 111. The elevator feed conveyor 111 is mounted in the main frame 11 and is disposed at right angles to the ram I feed conveyor 13. It is also constructed in a similar manner and consists of rollers 112 mounted on shafts 113 which are rotatably mounted in the main frame. Means is provided for positively driving each of the rollers 112 and consists of a gear motor 116 (see FIG. 24) which drives a sprocket 117. The sprocket 117 drives a chain 118 which drives a sprocket 119 affixed to a shaft 121 rotatably mounted in pillow blocks 122 which are mounted upon the main frame 11. The shaft 121 is connected to a brake clutch mechanism 123 which drives a chain 124 which drives the first roller 112. The brake clutch mechanism 123 includes solenoids SOL–31 and SOL–32. Pairs of sprockets 126 are mounted on the shafts 113 and are driven by chains 127 to drive the rollers 112 in much the same way as the rollers 14 are driven in the conveyor 13.

Length Sensing Means 131

As hereinafter explained, the block or article which has been cut is advanced by the conveyor 111. However, it should be pointed out that before the block or article is advanced, its length is sensed by length sensing means 131. This length sensing means consists of photosensitive sensing means identified as PC–1 (see FIGS. 11 and 14) which is mounted upon a support member 132. The photosensitive means PC–1 is adapted to receive light from a light source 133 mounted on a support member 134. Means is provided for shifting the position of the photosensitive means PC–1 until the article or block which has been advanced to the horizontal cutting means interrupts the passage of light to the photosensitive means PC–1. This means consists of a hydraulic actuator identified as Ram V mounted on the main frame (see FIGS. 1 and 5). Ram V is provided with a plunger 136 upon which the support member 132 is mounted.

A linkage 137 (see FIGS. 8, 10 and 11) is provided for connecting the photocell PC–1 and the lamp 133 so that they move in unison as Ram V is operated. This linkage 137 consists of an arm 138 which is pivotally connected by a pin 135 to the support member 132. The arm 138 is pivotally connected to a threaded member 139 at 141. The threaded member 139 is threaded into one end of a pair of arms 142 and is locked in an adjusted position by a knob 140. The pair of arms 142 are pivotally mounted on a fixed pin 143 mounted in a post 144 carried by the frame 11. An extension arm 145 is secured between the arms 142 by suitable means such as screws 146. The end of extension arm 145 is pivotally connected between a pair of arms 147 by a pin 148. A link 149 is pivotally connected to the arms 147 intermediate the ends of the same by pin 151. The other end of the link 149 is pivotally connected to a fixed pivot pin 152 mounted in a post 153 carried by frame 11. Another link 154 is pivotally connected between the ends of the arms 147 by a pin 156. The other end of the link 154 is pivotally connected to the support member 134 by a pin 157. The support member 134 is slidably mounted upon the framework for horizontal movement in brackets 158 mounted upon the frame 11.

With this arrangement, it can be seen that as the ram V is operated, the photocell PC–1 and the lamp 133 will be moved in unison longitudinally of the elevator feed conveyor to sense the length of the block placed on the elevator feed conveyor as hereinafter described. A switch S–21 is mounted on the frame 11 and is adapted to cause the cylinder V to return to its home position as hereinafter described. The switch S–21 is adapted to be operated by a cap screw 161 (FIG. 8) mounted in a block 162. The cap screw 161 is held in the desired adjusted position by a lock nut 163. The block 162 is slidably mounted in the support member 132 and is adjustably positioned therein by a threaded screw 164 which is rotatably mounted in the support member 132. A switch S–30 which serves as a back limit switch as hereinafter described is mounted on the main frame 11. This switch is adapted to be operated by a cap screw 166 which is threaded into the support member 132 and locked in the desired adjusted position by lock nut 167.

After the length of the block has been measured as hereinafter described, the block is advanced by the elevator feed conveyor 111 until it engages a stop plate 171 (FIG. 9). The stop plate 171 is hingedly mounted on its lower extremity at 172 on a movable support plate 173 and is prevented from falling forward by a lip 171*a* which engages the upper portion of the support plate 173. A switch housing 174 containing switches S–7, S–14 and S–23 is mounted upon the support plate 173 and is provided with an operating button 174*a* adapted to be operated by the stop plate 171 when the stop plate 171 is engaged by the block advanced by the elevator feed conveyor 111.

Centering Means 175

In certain applications of the apparatus as hereinafter described, it is desirable to position the stop plate 171 so that the block is centered for cutting operations of the type hereinafter described. Such centering means 175 (see FIGS. 9–11) is actuated by the length sensing means 131 and consists of upper and lower links 176 and 177 which are pivotally connected between ears 178 provided on opposite sides of the movable support plate 173. The upper links 176 are pivotally connected

to links **181.** The links **181** are also pivotally connected to an arm **182** which is affixed to the main frame **11.** A pair of arms **183** are pivotally mounted on the arm **182** by a pin **184.** The arms are also pivotally connected to the upper arms **176** by pins **186.** Extensions **187** are rigidly secured between the arms **183** and are pivotally connected at **188** to a pair of arms **189.** The arms **189** are pivotally connected to the lower links **177** and between a yoke **191** at **192.** The yoke **191** is pivotally connected to an arm **193.** The lower portions of the arms **189** are pivotally connected by pins **194** to lugs **195** secured to the frame **11.**

The arms **193** are adapted to be secured to the arms **142** and **147** by suitable means such as pins **196** so that the support plate **173** is moved with the arms **142** and **147.** Alternatively, the arms **142** can be held in a fixed position by removing the pins **196** and placing them in holes **197** in the arms **193** and into posts **198** mounted on the frame **111.**

When the support plate **173** is connected to the arms **142** and **147** by the pins **196,** the support plate is moved longitudinally of the elevator feed conveyor **111** along with the photocell PC–1 and the lamp **133** of the length sensing means **131.** The linkage provided is such so that the stop plate **171** is always maintained in a substantially vertical position and is not canted in one direction or another by a block which may engage the same. This is true because the support plate **173** is supported at all of its four corners and any loading on one of the corners will be distributed over the entire support plate by the linkage provided. As hereinafter described, by connecting the linkage for the support plate **173** to the length sensing means, the support plate **173** is positioned so that the stop plate will be engaged by the block of cheese at a point which will center the block of cheese regardless of the size of the block of cheese so that it will be properly positioned for future cutting operations as hereinafter described.

Suitable means such as hereinbefore described is provided for operating cylinder V and consists of fluid supplied from the piping **107** to a valve V–**8** which is controlled by solenoids SOL–**23** and SOL–**24.** The valve V–**8** is connected to tanks T–**10** and T–**11.** A stop valve V–**9** controlled by a solenoid SOL–**25** is provided for stopping the flow of fluid when the photoelectric sensing means PC–1 senses the leading edge of the block on the conveyor **111** as hereinafter described.

Similar means is provided for controlling cylinder IV hereinbefore described and consists of a valve V–**11** which is connected to the piping **107** and which is controlled by solenoids SOL–**28** and SOL–**29.** Fluid is supplied from the valve **11** to tanks T–**14** and T–**15** to cause fluid to flow therefrom. A stop valve V–**12** is provided for stopping the flow of fluid when the photosensitive means in the form of switch PC–2 senses the top of the block.

Vertical Cutting Means 201

The length sensing means **131** is also utilized for adjusting additional or vertical cutting means **201** (FIGS. **1** and **9**) when the vertical cutting means is used. The vertical cutting means consists of an outer rectangular frame **202** and an inner rectangular frame **203.** The inner frame **203** is provided with vertically aligned, horizontally spaced openings **204** through which cutting wires **206** extend. The ends of the cutting wires **206** are secured to carriages **207** which are very similar to the carriages **62** hereinbefore described in connection with the horizontal cutting means **56.** Thus, each of the carriages **207** is provided with a large roller **208** and a pair of small rollers **209** mounted upon a block **211.** The large rollers ride upon the outer surface of the inner frame **203,** whereas the small rollers **209** ride in grooves **212** provided in horizontal members **213** secured to the inner frame **203.** The ends of the cutting wires **206** are secured to rolls or barrels **214** to retain the desired tension on the wires.

Means is provided for adjusting the positions of the carriages **207** to thereby adjust the positions of the vertical cutting wires **206** within the inner frame **203** and consists of a plurality of upper arms **216** which are pivotally connected an the arm **217** and a plurality of lower arms **218** which are pivotally connected to the arm **138** forming a part of the length sensing means **131.** One end of each of the arms **216** and **218** is connected to a lever arm **221** which is pivotally mounted on a pin **222** secured to the outer frame **202.** The other ends of the arms **216** are pivotally connected to the inner frame **203** by pins **223.** The upper carriages **207** are pivotally connected to the arms **216** at different points depending upon their position along the inner frame **203** so that as the upper end of the arm **221** is shifted to the right as viewed in FIG. **13,** the ones nearest the right-hand edge will be shifted the least, whereas the one farthest removed will be shifted the greatest amount. This is readily accomplished as can be seen from FIG. **13** by merely pivotally connecting each succeeding carriage at a higher point on the associated arm **216.** Thus, for three of the carriages, extensions **224** are provided which are pivotally connected to the arms **216** by links **226.** For others, links **226** alone are provided and for one, the arm **216** is pivotally connected directly to the associated carriage **207.**

Intermediate portions of the lower arms **218** are pivotally connected by pins **227** to a member **228** secured to the lower member **213** in FIG. **13.** The arms **218** are various lengths and have their ends pivotally connected to the lower carriages **207** by links **229.** For certain carriages, extensions **231** are provided on the blocks **211** which are pivotally connected to the links as can be seen from FIG. **13.**

From the arrangement shown in FIG. **13,** it can be seen that the associated upper and lower carriages carrying the same wire **206** will be moved in unison by the linkage hereinbefore described and that the spaced parallel cutting elements or wires **206** will be moved a distance which is proportional to the distances they are form the right as viewed in FIG. **13.** It is for this reason that the openings **204** from the left become progressively smaller. Thus, it can be seen that the carriages **207** will be positioned in accordance with the length of the article sensed to thereby divide the length of the article to be cut into equal increments to reduce waste during the cutting operation to a minimum as hereinafter described. Cover plates **230** serve to cover the principal moving parts of the vertical cutting means.

Means is provided so that the vertical cutting means **201** can be removed when desired. This means consists of a knob **231** which carries the threaded rod **232** extending through the main frame **11** and threaded into the inner frame **203** to releasably hold the vertical cutting means **138** in position on the main frame **11.**

When vertical cutting means is not required as, for example, in the die cutting operations as hereinafter

described, the vertical cutting means **201** can be removed by removing the threaded rod **232.** In its place there can be substituted a rectangular frame **234** (FIG. 1A) which can be secured to the main frame by threading the rod **232** into it. This frame **234** is provided with an upper surface which is at the same level as the upper surface of the lower portion of the inner frame **203.**

Elevator Assembly **241**

At the time that the block is advanced into engagement with the stop plate **171** by the elevator feed conveyor **111,** the block is also advanced onto an elevator assembly **241.** This elevator assembly **241** (see FIG. **9**) consists of a rectangular U-shaped framework **242** which serves as a platform. A plurality of sleeve-like "Delrin" rollers **243** are rotatably mounted on shafts **244.** The shafts **244** are carried by pins **245** rotatably mounted in the framework **242.** One-way clutches **246** (see FIG. **26**) of a conventional type mounted such as manufactured by Helander Products, Inc. of Clinton, Conn., are on the pins **245** and as shown in FIG. **9** consists of cam plates **246***a* affixed to the pins **245** and the shafts **244.** A knurled cap **246***b* is mounted in the end of each Delrin sleeve **243.** Means is provided to only permit rotation of caps **246***b* relative to the cam plate **246***a* in one direction and consists of rollers **246***c* mounted in slots **246***d* in the cam plate **246***a* and yieldably urged in one direction by springs **246***e*. The one-way clutches **246** permit rotation of the sleeve-like rollers **244** in one direction only, that is, in a direction in which the block can be moved thereon into engagement with the stop plate **171.** Thus, when a block engages the stop plate **171,** it cannot bounce or roll backwardly because of the one-way clutches provided on the rollers **243.** For this reason, the block will be maintained in a precise position on the framework **243** of the elevator assembly **241** as soon as the stop plate **171** is engaged to operate the associated switches S–7, S–14 and S–23.

The framework **242** is normally positioned at an elevation so that the upper surface of the rollers **243** lie in the same plane as the upper surfaces of the rollers **112** of the elevator feed conveyor **111.** The framework **242** is supported in this position by elevator cylinder VI supported upon the main frame **11.** The cylinder VI is provided with a plunger **247** which is affixed to a boss **248** mounted on the lower portion of the framework **242.** As can be seen from FIG. **9,** the cylinder VI is mounted so that its plunger **247** moves in a vertical direction so that as the plunger **247** is raised and lowered, the platform-like framework **242** is raised and lowered. The plunger **247** is provided with an extension **249** which carries an operating arms **252** of switches S–22 and S–26 as the cylinder VI is operated to raise the lower the platform **242.**

Another switch S–17 is associated with the elevator assembly **241** and is mounted upon a strap **254** carried by the framework **11.** The switch S–17 is provided with an operating foot **256** which is adapted to be engaged by the top of the block on the elevator as it is raised by the elevator assembly **241** for a purpose hereinafter described.

Means is provided for operating elevator ram VI similar to that hereinbefore described for the other cylinders and rams and consists of fluid supplied from the piping **107** to a valve V–14 which is controlled by solenoids SOL–20 and SOL–21. The valve V–14 is connected to tanks T–8 and T–9. A stop valve V–13 is connected to the tank T–8 and is provided for controlling the flow of fluid from the ram VI. A flow control valve **256** is also provided, which is not shown in the schematic diagram in FIG. **26.**

Ram II

As hereinbefore pointed out, the block, before it is advanced onto the elevator assembly **241,** has been cut in a horizontal direction to provide a plurality of superposed slices which form the block. Means is provided for advancing the slices one by one through the vertical cutting means **201** and consists of ram II which is mounted on the main frame **11** (see FIG. **12**). The ram II is provided with a plunger **261.** A plate **262** is mounted on the plunger **261.** A block **263** of suitable material such as plastic is secured to the plate **262** and is provided with a plurality of spaced, parallel, vertically extending slots **264** (see FIG. **1**) which are spaced so that they are adapted to receive the vertical cutting wires or elements **206.** The block **263** is formed in this manner so that it can push off the top slice from the block through the vertical cutting wires to cut the block vertically into a plurality of smaller elongate blocks. Since the block **263** is provided with slots, the block can extend through the wires **206** and can push the top slice completely through the wires so that it is in front of the ram III. The plate **262** is provided with a way **262** (FIG. **12**) on one side which receives a bar **265** and serves to guide the block **263** in its movement. A switch operating member **266** is carried by the plate **262** and which is adapted to operate switches S–1 and S–13 (FIG. **12**) mounted on the main frame. Another switch S–20 is mounted on the frame **11** (FIG. **12**) and is operated on return of ram II.

Centering Means **267** in Front of Ram III

At the same time that ram II is operated, centering means **267** may be placed in operation as hereinafter described to center the blocks which are advanced by ram II in front of ram III. This centering means consists of a push cylinder VII which underlies the ram II and which is provided with a plunger **268** and is adapted to be advanced by the ram VII into engagement with the block to hold the block up against the plate **230** of the vertical cutting means **201** for the purpose of centering the blocks which have been cut by the vertical cutting means **201** in front of the ram III, as hereinafter described. A switch S–15 is mounted on the frame **11** (FIG. **3**) and is operated when the push cylinder VII returns.

Means is provided for operating ram II and consists of compressed air which is supplied through piping **107** through a valve V–2 which is controlled by solenoids SOL–11 and SOL–12. The valve V–2 is connected to tanks T–3 and T–4 which are connected to opposite ends of the ram II. Similar means is provided for operating the push cylinder VII and consists of fluid which is supplied by the piping **107** to a valve V–3 which is controlled by solenoids SOL–13 and SOL–14. The valve V–3 is connected to tanks T–5 and I–6 which are connected to opposite ends of the cylinder VII. A pressure switch PS–2 is connected to the line from tank T–5. A valve V–5 controlled by solenoid SOL–15 is mounted in the line from tank T–5, and a valve V–6 controlled by solenoid SOL–16 is mounted in the line to tank T–6. As hereinafter described, when the pres-

sure builds up behind the push cylinder VII after the sensing plate **269** has engaged the block, the pressure switch PS–2 is operated to prevent flow of additional fluid to advance the cylinder VII. The fluid which is discharged as the ram VII is advanced is supplied to stop cylinders VII and IX. As hereinafter explained, since the stop cylinders VIII and IX are of the same size as the cylinder VII, the fluid supplied to the stop cylinders VIII and IX from cylinder VII will cause the cylinders VIII and IX to be only advanced one-half the distance that the cylinder VII is advanced to thereby provide centering of the elongate blocks before the ram III.

The cylinders VIII and IX are connected to tank T–7. The flow from tank T–7 is controlled by valve V–4 which is controlled by solenoids SOL–18 and SOL–19. The cylinders VIII and IX are provided with plungers **271** and **272** on which is mounted a support plate **273**. A stop plate **274** is mounted on the support plate **273** for hinged movement about a point **276**. A switch housing **277** is mounted upon the support plate **273** and has mounted therein the switches S–2, S–8 and S–11 (see FIG. **14**) which are operated by the operating pin **278** which extends through the support plate **273** and is adapted to be engaged by the stop plate **274** when the stop plate is engaged by blocks advanced by the ram II. Another switch S–16 (FIG. **14**) is mounted on the frame **11** and is operated by the housing **277** when the stop cylinders VIII and IX return to their home positions.

Ram III Conveyor Assembly **286**

As the blocks are advanced into engagement with the stop plate **274**, the blocks are also advanced onto a ram III conveyor assembly **286** which is positioned ahead of the ram III. The ram III conveyor assembly consists of a framework **287** (see FIG. **15**) mounted within the main framework **11** so that it can be shifted to an out-of-the-way position as hereinafter described. A plurality of parallel spaced rollers **288** are mounted upon shafts **289** which are rotatably mounted upon the framework **287** by suitable means such as end plates **291** and **292**. As can be seen from FIG. **15**, the rollers **288** lie in a horizontal plane and are arranged so they rotate in the direction of travel of the blocks as they are advanced by the ram II into engagement with the stop plate **274**. An additional roller **293** mounted upon a shaft **294** rotatably mounted in brackets **296** carried by the frame **11** is provided for bridging the space between the vertical cutting means **201** and the rollers **288** forming a part of the ram III conveyor assembly **286**.

The ram III conveyor assembly **286** also includes means for raising the blocks off of the rollers **288** at the time they are to be advanced by the ram III which consists of a plurality of spaced parallel fork-like blades **201** which are disposed between the spaced rollers **288** and which, in a normal position, lie in a horizontal plane which is below the horizontal plane in which the top surfaces of the rollers **288** lie. The blades **301** are directly secured to a block **302** formed of a suitable material such as plastic with the exception of one blade which is secured to the block **302** by a curved member **303**. A pair of carriages **304** is secured to the block **302**. Each carriage is provided with a grooved wheel **306** rotatably mounted in an L-shaped bracket **307** secured to the block **302** by suitable means such as screws **308**. The wheels **306** are adapted to travel upon a pair of rods **309**. Downwardly depending ears **311** are secured to the ends of the rods **309** and are pivotally connected to lugs **312** which are secured to a shaft **313**. The shaft **313** is rotatably mounted in pillow blocks **314** mounted on the framework **287**.

Means is provided for rotating the shaft **313** and consists of a ram X which is pivotally connected to the frame **287** at point **316** and which has a plunger **317** with a clevis mounted on the outer end. The clevis **318** is pivotally connected to a lug **319** which is keyed to the shaft **313**. It can be seen that the lugs **312** are normally in an inclined position so that the fork-like blades **301** are at elevations which are slightly below the upper surfaces provided by the rollers **288**. When the plunger **317** is advanced, the lugs **312** are moved toward a vertical position to raise the rods **309** and the carriages which travel thereon so that the upper surfaces of the fork-like blades **301** are positioned or lifted above the rollers **288** to lift the blocks out of engagement with the rollers.

The block **302** is carried by the plunger **322** of ram III. The block **302** is provided with a plurality of spaced vertical recesses **324** to accommodate the cutting elements of the supplemental vertical cutting elements hereinafter described. Ram III is pivoted at **325** to the main frame **11** (see FIG. **1**).

A switch operating member **326** is carried upon a support member **327** mounted on bracket **328** secured to the block **302** and is adapted to operate two switches S–9 and S–3 mounted upon the main frame **11** as shown particularly in FIG. **15**.

Suitable means is provided for operating ram III and cylinder X and, as shown in FIG. **26**, a fluid is supplied from line **107** through valve V–1 which is controlled by solenoids SOL–1 and SOL–2. The valves are connected to tanks T–1 and T–2 which are connected to opposite ends of the ram III. The tanks T–1 and T–2 are also connected to opposite ends of the cylinder X.

Supplemental Vertical Cutting Means **331**

Supplemental vertical cutting means **331** is provided on the frame **11** for cutting the elongate blocks or parts as they are advanced by the ram III. This additional vertical cutting means consists of a framework **332** in which one or more parallel spaced vertical cutting elements **333** are mounted. The cutting element **333** shown in FIG. **14** is formed of a rod **334** mounted in the framework **332**. The rod **334** has been machined to provide the elongate cutting member **333**, which is wedge shaped in cross-section, with a sharp edge facing toward ram III. This wedge-shaped configuration spreads the blocks apart so that they will not adhere to each other after they have been cut. The supplemental vertical cutting means **331** is readily interchangeable with other supplemental vertical cutting means in which the spacing between the cutting wires is different to thereby make it possible to cut the elongate blocks of various numbers of separate parts.

Thus, it can be seen that as the fork-like blades **301** are raised, they are also advanced by the ram III to advance the slices which have been cut into elongate blocks or parts by the first vertical cutting means **201** as a unit through the second or supplemental vertical cutting means **331** to cut the elongate parts into smaller parts and to advance the slice in a direction which is at right angles to the direction in which the slice was advanced through the first vertical cutting means. As pointed out previously, the block **332** advanced by the

ram III is provided with recesses **324** so that the slice can be completely advanced through the vertical cutting means **331.** They are deposited upon a first delivery conveyor **341,** and the ram III and cylinder I return to home positions as hereinafter described.

Delivery Conveyors **341** and **351**

The first delivery conveyor **341** consists of a plurality of four chain belts **342** formed of a suitable material such as stainless steel covered with Delrin which are carried on Delrin pulleys **343** mounted on a shaft **344** rotatably mounted in the frame **11.** The belts are also carried by pulleys **346** rotatably mounted upon another shaft **347** rotatably mounted in the frame **11.** As can be seen particularly from FIG. **24,** the belts **342** travel in spaced parallel paths and are spaced apart so that the blades **301** can be lowered between the same to deposit the cut parts or blocks carried by the blades onto the belts **342.** Relatively shallow channel members **348** are mounted upon the frame **11** and are adapted to receive the belts **342** and to guide the same.

A second or additional delivery conveyor **351** is adapted to receive the parts from the delivery conveyor **341** and consists of a plurality of chain belts **352.** The chain belts **352** are of a conventional construction and consist of a plurality of links **353** (see FIG. **27F**) which are pivotally interconnected by smaller links **354.** Carrying plates or tops **356** of a suitable material such as Delrin are mounted on the links **353.** At certain spaced intervals, the chain belts **352** are provided with upstanding lugs **357** which are adapted to positively advance the product thereon in a timed relationship as hereinafter described. As is also well known to those skilled in the art, the chain belts **352** are provided with grooves (not shown) which are seated on raised portions **358***a* formed on bars **358** extending substantially longitudinally of the additional delivery conveyor **351.** As shown in FIG. **21,** the rear ends of the bars **358** are pivotally connected to the frame **11** by suitable means such as screws **359.** The other ends of the bars are secured to channel members **360** which rest upon the framework **11** and are guided by the chain belts **352** as they are adjusted laterally as hereinafter described. As can be seen in FIG. **23,** the upper sides of the channel members **260** extend above the tops **356** of the chain belt. The channel members are formed with upwardly and forwardly inclined portions **360***a.*

The forward ends of the chain belts **352** travel over three separate sprocket wheel assemblies **361, 362** and **363,** each of which is provided with three sprockets **364** and over which the chain belts **352** travel. The sprocket wheel assemblies **361, 362** and **363** are mounted on a shaft **366** in such a manner that the spacing between the chain belts **352** can be adjusted. Thus, the sprocket wheel assembly **362** is fixed to the shaft, whereas the sprocket wheel assemblies **361** and **363** are keyed to the shaft **366** for movement axially of the shaft. The shaft **366** is rotatably mounted upon the main frame **11** by bearings **367** mounted upon the frame **11.**

Means is provided for shifting the sprocket assemblies **361** and **363** on the shaft **366** and consists of a hand lever **371** which is pivotally mounted upon the frame **11** at **372.** The lever **371** is provided with an extension **373** which seats in a groove **374** formed in a collar **376.** The hand lever **371** is pivotally connected to another lever **377** by a link **378.** The lever **371** is pivoted on the frame **11** at **379.** The lever arm is provided with an extension **381** which is adapted to travel in a groove **382** provided in a collar **383** secured to the sprocket wheel assembly **363.** It can be seen that as the hand lever **371** is operated between the solid line position and the broken line position shown in FIG. **22** that the outer sprocket wheel assemblies **361** and **363** are shifted axially of the shaft **366** with respect to the center sprocket wheel assembly **362.** In this manner, it is possible to adjust the additional or second delivery conveyor **351** so that it can either carry two parts or blocks abreast or three parts or blocks abreast.

It will be noted from FIG. **22** that of the three chain belts **352** carried by the sprocket **361,** the center chain belt is narrower than the other two. The same is true of the belts **352** carried by the sprocket wheel assembly **363.** The center chain belts **352** carried by the sprocket wheel assemblies **361** and **363** are mounted upon sprockets **386** which are rotatably mounted upon the shaft **347.**

The chain belts **352** provided on the center sprocket wheel assembly **362** consist of one wide belt and two outer narrower belts. The two narrower belts are mounted upon sprockets **388** secured to a shaft **389** rotatably mounted in pillow blocks (not shown) mounted upon the main frame **11** (see FIG. **24**). The wider belt carried by the sprocket wheel assembly **362** is rotatably mounted upon a sprocket **392** rotatably mounted upon the shaft **347** (FIG. **21**). The wider chain belts **352** carried by the outer sprocket wheel assemblies **361** and **363** are rotatably mounted upon sprockets **393** which are mounted upon a shaft **394.** One end of the shaft **394** is mounted in a bearing **396** secured to the main frame **11** and the other end of the shaft **394** is mounted in a clutch-brake unit **397** of a conventional type which is mounted on the main frame. The clutch-brake unit **397** includes a clutch solenoid SOL–**36** and a brake solenoid SOL–**37.** The clutch-brake unit **397** is provided with an output shaft **389** upon which is mounted a sprocket **399** which drives a chain **401.** The chain **401** drives sprocket **402** of a substantially larger diameter which is mounted on the shaft **347** and drives the shaft **374** of the first delivery conveyor **341.**

The additional delivery conveyor **351** is provided with supplemental article or block driving means at its infeed end which consists of a plurality of rollers **406** formed of a suitable material such as sponge rubber which are mounted on a shaft **407.** The shaft **407** is rotatably mounted upon the main frame **11** by bearings **408.** The rollers **406** frictionally engage the shaft **407** so that they can be readily shifted axially of the shaft to any position desired.

Means is provided for driving the shaft **407** from the additional delivery conveyor **351** and consists of a spur gear **409** which is secured to the shaft **394** and which drives a smaller spur gear **411** affixed to the shaft **407.** Thus, it can be seen that as the shaft **394** is rotated, the shaft **407** will be rotated.

The delivery conveyor **341** also includes additional drive means at its outfeed end which consists of a plurality of rollers **413** formed of a suitable material such as sponge rubber which are spaced on a shaft **414.** The rollers **413** like the rollers **406** can be readily shifted axially of the shaft **414** to the desired positions. The shaft **414** is rotatably mounted upon the framework **11** by bearings **416.** Means is provided for driving the shaft **414** from the shaft **347** of the delivery conveyor **341**

and consists of a spur gear **417** which is affixed to the shaft **347** which drives a smaller spur gear **418** affixed to the shaft **414.** Thus it can be seen that as the shaft **347** is rotated, the shaft **414** will be rotated.

Means is provided for driving the additional delivery conveyor **351** from the wrapping machine with which the apparatus is to be used. By way of example, one wrapping machine represented schematically at **421** can be of a type manufactured by the Hudson Sharp Plant of FMC Corporation which is provided with a shaft **422** which operates in a timed relationship with respect to the travel of the conveyor **423** to which the articles to be wrapped are to be delivered. A sprocket **424** is mounted on this continuously rotating shaft **422** and drives a chain **426.** The chain **426** drives a sprocket **427** of an angle gear **428** which is mounted on the framework **11.** The angle gear can be of any suitable type such as a Model R–333 manufactured by Airborne Accessories Corp. of Hillside, N.J. The angle gear drives a shaft **431** upon which two sprocket wheels **432** and **433** are affixed. The sprocket wheel **432** drives a chain **434** and the chain **434** drives a sprocket **436** which is rotatably mounted upon the shaft **366.** The sprocket wheel **433** drives a chain **437** which drives a sprocket wheel **438** rotatably mounted on the shaft **366.** A collar **439** is keyed to the shaft **366** but is movably axially of the shaft **366** so that jaws **441** carried thereby can engage either the jaws **442** carried by the sprockets **436** and **438** so that the shaft **366** can be driven by either the sprocket wheel **436** or by the sprocket wheel **438.** The tooth ratio between the sprockets **432** and **436** is such that there is a 1:1 ratio in the drive, whereas the tooth ratio between the sprockets **433** and **438** is such that the ratio is 1-½:1. It can be seen that the collar **439** and the sprockets **436** and **438** form a jaw clutch which is utilized for driving the shaft **366** at two different speeds. This dual speed arrangement is utilized for a purpose hereinafter described.

Means is provided for shifting the collar **439** to engage either the sprocket **436** or the sprocket **438** and consists of a link **444** which is pivotally connected to the lever arm **377** at **446.** The link **446** is also pivotally connected to an arm **447** at **448.** The arm **447** is pivotally mounted on the main frame **11** at **449** and carries an extension **451** which is adapted to engage a groove **452** provided in the collar **439.** From this arrangement, it can be seen that when the hand lever **371** is operated to move the outer sprocket wheel assemblies **361** and **363** into closer proximity with the sprocket wheel assembly **362** that at the same time the collar **439** is moved into engagement with the sprocket **438** so that the shaft **366** will be driven at a faster speed. Conversely, when the lever arm is moved to the solid line position as shown in FIG. **22,** the outer sprocket wheel assemblies **361** and **363** are moved apart from the sprocket wheel assembly **362,** and at the same time, the collar **439** is moved into engagement with the sprocket wheel **436** to cause the shaft **366** to rotate at a slower speed.

A cam wheel **454** (FIG. **22**) is mounted on the shaft **366** and is driven with the shaft. The cam wheel **454** is provided with a single lobe **454***a* which is adapted to operate a switch S–**45** for controlling the brake-clutch unit **397** as hereinafter described.

A pulse accumulator **456** (FIG. **24**) is provided with electronically accumulates the pulses which are produced by a magnetic switch S–**46** and produces a switch closure after every eight, **10, 14** or **21** articles are delivered to the wrapping machine depending upon which number is selected on the pulse accumulator. The pulse accumulator can be of any suitable type such as one manufactured by Tensor Manufacturing Company of Monterey, Calif.

The magnetic switch S–**46** can also be of any suitable type such as one manufactured by Tensor Manufacturing Company. The switch S–**46** is operated by a small permanent bar magnet **458** mounted on the end of a shaft **459** of the wrapping machine **421.** The shaft **459** makes one rotation for each article wrapped by the wrapping machine so that a pulse is supplied to the pulse accumulator **456** for each article wrapped.

DESCRIPTION OF ADDITIONAL COMPONENTS USED FOR DIE CUTTING

As hereinafter explained, the apparatus for cutting and handling articles herein described, in addition to being used for cutting large blocks into smaller rectangular consumersized blocks, can also be utilized for cutting large blocks into consumer-sized blocks having a particular configuration by utilizing die cutting means.

When the apparatus is to be used for die cutting, the entire ram III conveyor assembly **286** with ram III and its associated parts mounted on the framework **287** is moved to the rear of an out-of-the-way position as shown in FIG. **1A.** As hereinbefore explained, a frame **234** is positioned in the frame **11** in place of the vertical cutting means **201** and the framework **332** forming the supplemental vertical cutting means **331** is removed. A teflon covered platform **471** (see FIG. **4**) is disposed in the main frame in the position generally occupied by the ram III conveyor assembly **386.** This product platform is adapted to be raised and lowered as hereinafter described. A die cutting mechanism **472** is mounted on the framework **11** and operates in conjunction with the product platform **471** as hereinafter described.

Die Cutting Assembly **472**

The die cutting assembly **472** consists of a large cross-shaped member **473** which is provided with three arms **474** of the same length and an arm **476** which is slightly longer. The cross-shaped member **473** is supported upon a cylindrical hollow post **477** which is supported in a sleeve **478** rotatably mounted in a housing **479** secured to the main frame **11.** The sleeve **478** is connected to a connector assembly **483** which is connected to the spindle (not shown) of an indexing table **486** of a suitable type such as one manufactured by Air Hydraulics, Inc. of Jackson, Mich.

The indexing table **486** is mounted upon the main frame **11** which includes a cross brace **487.** A tensioning rod **488** extends through the post **477** and through the indexing table **486.** A plate **491** is mounted on the rod **488** above the cross-shaped member **473.** A nut **492** is threaded on the rod **488** and engages the plate **491.** A nut **493** is threaded on the other end of the rod **488** and engages the main frame **11** and extends through the longer arm **476** of the cross-shaped member **473** and also through the brace **487.** Nuts **497** and **498** are threaded on opposite ends of the rod **496.** From the construction hereinbefore described, it can be seen that the tensioning rods **488** and **496** tie the framework **11,** the cross-shaped member **473,** the post

477, the table **486** and the brace **487** into a rigid rectangular framework **499** which is particularly adapted to withstand the relatively large stresses which are built up in the die cutting mechanism **472** during the die cutting operation.

The die cutting mechanism **472** also includes an additional cross-shaped member **501** which is provided with four arms **502.** The cross-shaped member **501** is secured to the sleeve **478** so that it is rotated by the indexing table **486** as the indexing table **486** is operated as hereinafter described. The arms **502** are disposed in a horizontal plane and extend radially from the sleeve **478** and are spaced 90° from each other.

A die cutting assembly **504** is mounted on each of the arms **502.** Each die cutting assembly **504** consists of an upper rectangular framework **506.** Suitable means is provided for securing the framework **506** to the arm **502** and consists of a tongue and groove connection **507** and a rod **508** which is threaded into the framework **506** and a nut **508***a* which is threaded on the rod and engages the arm **502.** Each die cutting assembly **504** also includes a lower rectangular plate **509** (FIG. **17**). The lower ends of vertical rods **510** are rigidly secured to the lower plate **509** and extend upwardly through the rectangular framework **506** and are secured thereto by suitable means such as cap screws **511.** Support posts **512** are mounted on the cross-shaped member **473** for supporting the die cutting assemblies **504** during a die cutting operation as hereinafter described.

The die cutting assembly **504** also includes an upper plate **513** which is disposed above the lower plate **509** and below the framework **506.** The upper plate **513** is provided with holes **514** to accommodate the rods **510** as shown in FIG. **18.** L-shaped brackets **516** are secured to the upper plate **513** and are also provided with holes **517** to accommodate the rods **510.**

Means is provided for yieldably supporting the upper plate **513** above the lower plate **509** and consists of springs **518** which are axially disposed on the rods **510.** The springs **518** extend through the holes **514** and the upper plate **513** and have their lower ends engaging the lower plate **509** and their upper ends engaging the brackets **516.** A plurality of die cutting members **521** are mounted on the lower plate **509** and can have any desired configuration. For example, as shown in FIG. **19,** the die cutting members **521** are generally semi-circular in cross-section to make it possible to cut semi-circular blocks of cheese from slices as hereinafter described to provide a configuration which is normally associated with Longhorn cheese. In the arrangement shown in FIG. **19,** eight such dies have been provided arranged in two rows of four each.

A produce push-out member **522** is disposed in each of the die cutting members **521** and is formed of a suitable material such as Delrin. As can be seen, the product push-out members **522** are also semi-circular in shape but have a size which is substantially less than the cross-sectional area of the die cutting members **521.** Means is provided for mounting the product push-out members **522** so that they move with the upper plate **513** and consists of three vertical posts **523** which are secured to the members **522** and to the upper plate **513** as shown in FIG. **20.** The posts **523** extend through openings **524** provided in the lower plate **509.**

Trim push-out means is also carried by the upper plate **513** and consists of a plurality of blocks **526** of a suitable material such as plastic which have inner curved surfaces **526***a* and inner flat surfaces **526***b* which conform to the outer surfaces of the die cutting members **521** and which take up the space between the die cutting members **521** to push out the remaining trim from the die cutting assembly **504** as hereinafter described.

Additional trim push-out means is provided and consists of blocks **528** which are disposed on the outer sides of the die cutting members **521** below the lower surface of the lower plate **509.** The blocks **528** are supported by rods **529** (FIG. **20**) which are threaded into the blocks and are slidably mounted in bushings **531** and **532** provided in the lower plate **509** and the upper plate **513.** The rods **529** are also mounted in the upper plate **513.** Upper and lower collars **534** and **536** are provided on each of the rods with the upper collar **534** being disposed above the upper plate **513** and the lower collar **536** being disposed below the plate **513** as shown in FIG. **20.**

Trim retaining means is also mounted on each of the die cutting assemblies **504** and consists of a plurality of spaced spring-like fingers **538** which are loosely mounted on cap screws **539** threaded into the lower plate **509.** The upper extremities of the fingers **538** are received by in-turned U-shaped portions **541***a* of members **541** secured to the lower plate **509.** A spring **542** is axially mounted on each of the cap screws **539** and serves to urge a curved portion **538***a* of each of the fingers **538** yieldably into engagement with the die cutting members **521** as shown particularly in FIG. **20.**

A vertically extending actuating rod or stub shaft **546** is mounted in a flanged collar **547** which is secured to the upper plate **513** by suitable means such as cap screws **548.** The actuating shaft **546** is slidably mounted in the framework **506** of the die cutting assembly **504.**

Means is provided for engaging the actuating shaft **546** to cause operation of the product push-out means and consists of a product push-out cylinder XI which is mounted on the arm **474** overlying the first delivery conveyor **341.** The product push-out cylinder XI is provided with a plunger **551** which is adapted to engage the actuating shaft **546** as shown in FIG. 3A. A switch **S-6** is mounted on the same arm **474** and is adapted to be operated when the plunger **551** of the product push cylinder XI is fully advanced. A switch **S–18** is also mounted on the same arm **474** and is operated when the plunger **551** is first advanced.

Means is provided for engaging the actuating shaft **546** to cause operation of the trim push means consisting of blocks **526** and the additional trim push means comprising the blocks **528** and consists of a cylinder XII mounted on another of the arms **474** overlying the framework **11.** The trim push cylinder XII is provided with a plunger **552** which is adapted to engage the actuating shaft **546** to cause operation of the trim push means as hereinafter described. A switch **S–12** is mounted on the arm **474** and is adapted to be operated when the plunger **552** of the trim push cylinder XII is fully advanced. A switch **S–19** is also mounted on the same arm **474** and is operated as soon as the plunger is advanced.

Means is mounted on the frame for receiving the trim ejected when the trim push means is operated by the trim push cylinder XII and consists of a large bag **556** which is removably mounted on the frame **11.**

Means is provided for operating the indexing table **486** and consists of a hydraulic cylinder XIII (see FIG. 4). A switch S–4 is mounted on the frame **11** and is adapted to be operated by the cylinder **13** when the indexing table **486** is to be cocked.

Die Cut Ram XIV

Means is provided for raising the lowering the platform **471** to move a slice deposited upon the platform **471** by ram II into engagement with the die cutting members **521** and consists of a die cut ram XIV which is mounted upon a post **561** mounted in the framework **11.** The ram XIV is provided with a plunger **562** which is secured to a flanged collar **563** which is secured to the platform **471** mounted within the framework **11.**

Switches S–5 and S–10 are mounted on the frame **11** as shown in FIG. 3A. Means is provided for operating switches S–5 and S–10 and consists of an operating member **566** which is slidably mounted in a framework **11** and is attached to the collar **563** (FIG. 4) to move with the platform **471.** The member is provided with a portion **566***a* which is adapted to engage and operate switch S–5 and a portion **566***b* which is adapted to engage and operate switch S–10. The positioning of the portions **566***a* and **566***b* is such that the switch S–5 is operated before switch S–10.

The actuating cylinder XIII causes the index table to cause the sleeve **478** and the cross-shaped member **501** to be advanced in 90° steps each time the actuator **13** is operated as hereinafter described.

The apparatus also includes electrical circuitry as shown in FIGS. **28A**, **28B** and **28C**. This circuitry includes a number of electrical components such as switches, many of which have already been identified, solenoids, relays, etc., which are set forth in the lists below. The apparatus also includes hydraulic piping as shown in FIGS. **26** and **26A**.

SWITCHES

Switch	Function	Location
S-1	N.C. Interlock to prevent interference with Ram III	Extension of Ram II (last 1½" of travel)
S-2	N.O. cheese in position for Ram III	Ram III stop plate 274 (FIG. 14)
S-3	N.O. return switch	Extension of Ram III (FIG. 15)
S-4	N.O. cocking switch	Index table (FIG. 3A)
S-5	N.C.	Upper extension of die cut ram (FIG. 30)
	N.O. down switch	
S-6	N.O. return switch	Extension of product push (FIG. 3A)
S-7	N.O. cheese in position	Ram II stop plate (FIG. 9)
	feed roller circuit	
S-8	N.C. No cheese at ram III	Ram III stop plate (FIG. 14)
	in elevator up circuit	
S-9	N.O. closed when ram III	Ram III back (FIG. 15)
	is back	
S-10	N.O. Same as above	Die cut index 60° (FIG. 3A)
S-11	N.O. Ram II return switch	Ram III stop plate (FIG. 14)
S-12	N.O. return switch	Extension of trim push (FIG. 3A)
S-13	N.O. Interlock to prevent	Ram II back (last 1½ of travel) (FIG. 12)
	elevator from rising too soon	
S-14	N.O. cheese on elevator	II stop plate (FIG. 9)
S-15	N.C. back limit switch	Back of push cylinder (FIG. 3)
S-16	N.C. stop cylinder back	Back of stop cylinders (FIG. 16)
S-17	N.C. elevator up - Ram II ready to push off cheese	Top of block on elevator (FIGS. 12 and 14)
S-18	N.O. ready to index die cut	Product Cyl. Up (FIG. 3A)
S-19	N.O. ready to index die cut	Trim Cyl. Up (FIG. 3A)
S-20	N.O. Pulse Sw. to start Elev. & Ram I	Back of ram II (FIG. 3)
S-21	N.C. return switch	Extension of length measure (FIG. 8)
S-22	N.O. down elevator	Top of elevator stroke (FIG. 9)
S-23	N.C. start elevator feed rollers	Ram II stop plate 171 (FIG. 9)
S-24	1 N.C. stop infeed rollers 1 N.O. start ram I	Ram I stop plate 91 (FIG. 8)
S-25	N.O. return switch	Extension of ram I (FIG. 8)
S-26	2 N.O.	Bottom of elevator stroke (FIG. 9)
S-27	1 N.C. start new cycle 1 N.C. start feed rollers	Back of ram I (FIG. 2)
S-28	1 N.O. start height measure 1 N.C. hold rly 12 for up	Extension of height measure (FIG. 8)
S-29	1 N.O. return switch N.C. start measure cycle	Back limit of height measure (FIG. 8)
S-30	N.C. start measure cycle	Back limit of length measure (FIG. 8)
S-31	Manual start N.O.	Panel 571
S-32	Manual start N.O.	Panel 571
S-33	Manual start N.O.	Panel 571
S-34	Manual start N.O.	Panel 571
S-35	Manual stop N.C.	Panel 571
S-36	Manual start N.O.	Panel 571
S-37	Manual safety toggle	Panel 571
S-38	Bulk feed manual stop N.C. "start N.O.	Panel 571
S-39	Reset switch N.C.	Metal detector 41
S-45	N.O. cheese block feed	Chain feed conveyor (FIG. 22)
S-46	N.O. supply pulses to pulser	Wrapping machine (FIG. 24)
S-47	N.O. closed on predetermined count of pulser	Pulser 246 (FIG. 28A)
S-48	N.O. Slicing, closed die cutting	Pulser 246 (FIG. 28A)
S-49	Stop bulk feed conveyor	Metal detector 41

RELAYS

Relay	Function
RY-1	Ram III and die cut relay
2	Product & trim push relay
3	Centering relay — push
4	Centering relay — hold and return
5	Centering relay — return
6	Elevator & centering relay — control
7	Elevator relay — up
8	Elevator relay — down
9	Length measure relay — out
10	Length measure relay — in
11	Bulk feed relay
12	Height measure relay — up
13	Height measure relay — down
14	Ram I feed rollers relay
15	Ram I receive relay
16	Metal detector reset relay
17	Elevator feed relay
19	Die cut relay
20	Selector relay

PANIC BUTTONS

Pushbutton	Function
PB-1	Ram I emergency return
PB-2	Ram II emergency return
PB-3	Ram III emergency return

PRESSURE SWITCHES

Switch	Function
PS-1	Below 100 psi pressure in line 107
PS-2	Centering

PHOTOCELLS

Photocell	Function
PC-1	Length measure
PC-2	Height measure
PC-3	Initial stop
PC-4	Delivery conveyor stop

SOLENOIDS

Solenoid	Function	Solenoid	Function
SOL-1	III out	SOL-21	Elevator down
2	Ram III in	22	Elevator stop
3	Index	23	Length measure
4	Cock	24	Length measure
5	Die cut up limit	25	Length measure
6	Die cut down	26	Ram I out
7	Product push down	27	Ram I in
8	Product push up	28	Height measure up
9	Trim push down	29	Height measure down
10	Trim push up	30	Height measure stop
11	Ram II out	31	Clutch elevator feed
12	Ram II out	32	Brake elevator feed
13	Push	33	Brake bulk feed
14	Return	34	Clutch bulk feed
15	Push stop valve	35	Brake Ram I feed
16	Return stop valve	36	Clutch Ram I feed
17	Stop cylinder stop valve	37	Clutch Delivery Conveyor
18	Stop cylinder return	38	Brake Delivery Conveyor
19	Stop cylinder vent	39	Product stop valve
20	Elevator up		

The circuitry also includes a pulser **574** which can be of any suitable type such as type No. MEP6A manufactured by Tensor Corp. of Monterey, Calif. This pulser is supplied with power from the conventional source through a transformer T–1 which, for example, can reduce the voltage from **110** volts to 24 volts.

The operation of the apparatus in performing our method for cutting large blocks into small rectangular blocks or into small die cut blocks is set forth below.

OPERATION OF THE APPARATUS FOR CUTTING LARGE BLOCKS INTO SMALL RECTANGULAR BLOCKS

In describing the operation of our apparatus for forming small blocks in accordance with out method, let it be assumed that the articles to be handled and cut are large plastic blocks such as large approximately 40 pound rindless blocks of cheese which are approximately 11 inches wide, 14 inches long and 7 inches high. When such is the case, the bulk feed conveyor **31** with the associated metal detector **44** can be located in the cooling room for the cheese and can extend out of the cooling room through an opening provided in the wall of the cooling room (not shown). The operator of the apparatus in the cooling room will set the pulse accumulator **456** for the type of blocks which he is placing on the bulk feed conveyor **31.**

By way of example, let it be assumed that it is desired to cut the cheese blocks in such a manner that eight small blocks are formed from each slice of the large block. Thus, the operator in the cooling room sets the accumulator **456** so that it will produce a switch closure after eight small blocks or parts have been delivered to the conveyor **423** of the wrapping machine **421** and wrapped by the wrapping machine. The operator in the cooling room, after setting the pulse accumulator **456,** merely places the large block of cheese on the bulk conveyor **31** so that they are positioned one behind the other with a substantial spacing between the same. The belt is marked at two foot intervals and the blocks are placed on the belt so that the leading edges of the blocks are in line with the marks. The remaining operation of the apparatus is completely automatic as hereinafter described and is controlled by the wrapping machine **421.**

Now examining the circuit diagram which is shown in FIGS. **28A** and **28B**, the switch closure which is produced by the pulse accumulator **456** is represented by the switch S–**47** which is in a normally open position and which is moved to a closed position after a predetermined number of pulses have been received from the switch S–**46.**

Let it be assumed that the pulse accumulator has been set to accumulate **8** pulses from the pulse accumulator **456** driven by the wrapping machine and that the switch S–**48** forming a part of the pulse accumulator is in an open position so that the relay RY–**20** is not energized. When the relay RY–**20** is not energized, the circuitry is in a condition for cutting small rectangular consumer blocks rather than die cut consumer blocks.

Let is also be assumed that the apparatus has been in operation and that eight blocks have been wrapped by the wrapping machine and that it is necessary to deliver another slice cut from the block and cut into eight separate parts or rectangular consumer-sized blocks onto the first delivery conveyor **341.**

Ram III and Ram III Conveyor Assembly Operation

Thus, when the eight pulses have been received by the pulse accumulator **456,** the switch S–**47** is closed to energize the solenoid SOL–**1** to cause the ram III to be advanced. This circuit for the solenoid SOL–**1** is completed through switch S–**1** which is normally closed but which is held open by the last few inches of forward travel of ram II. Switch S–**1** is, therefore, a safety switch and prevents ram III from operating when ram II is is in the forward position and, therefore, prevents ram III from colliding with ram II. The circuit for energizing solenoid SOL–**1** is also completed through switch S–**2** which is located behind ram III stop plate **274.** This switch is normally open and is closed when a slice of cheese is in position ready for ram III to operate. Thus, ram III operates when ram II is sufficiently withdrawn and cheese is in position when switch S–**47** is closed.

Upon examining the piping diagram shown in FIG. **26,** it can be seen that energization of the solenoid SOL–**1** permits air to be supplied from piping **107** to the tank T–**1** which urges hydraulic fluid from the tank T–**1** into the rear of the ram III to cause the plunger **322** of ram III to be advanced. At the same time fluid is supplied to the rear of ram III, fluid is also supplied to the rear of cylinder X to also cause its plunger **317** to be advanced. The simultaneous advance of the plungers **322** and **317** of the ram III and cylinder X, respectively, causes the rods **309** to be raised to thereby raise the carriages **304** carrying the blades **301** to raise the entire slice of cheese above the upper surface of the rollers **288** at the same time that the block **302** is advanced by the plunger **322** to carry the spaced blades **301** with the slice thereon through the additional vertical cutting means **331.** The slice which is carried thereon has already been cut into four separate parts by the first named vertical cutting means **201** as hereinafter described and is now advanced through the additional

vertical cutting means **331** to be cut into eight parts as shown in FIGS. **29A** and **30E** and to place them upon the delivery conveyor **341.**

At the extreme forward stroke of the plunger **322** of ram III, the normally open switch S-3 is operated by the operating member **326** which causes energization of the solenoid SOL–2. It can be seen that many of the solenoids are mechanically interlocked and that only one of each pair of interlocked solenoids can be operated at a time. Energization of the solenoid SOL–2, therefore, stops the flow of fluid through the tank T–1 and causes fluid to be supplied by valve V–1 from the piping **107** to the tank T–2. Fluid from the tank T–2 is supplied to the front end of the ram III and into the front end of the cylinder X to cause both to be returned to their home positions. Fluid is returned to the tank T–1 and air is exhausted through the exhaust member **109.**

Ram II Operation

As the plunger **322** of ram III returns to its home position, a pulse switch S-9 is operated by the member **326.** This will cause energization of the solenoid SOL–11 if switch S–7 is closed indicating that there is cheese on the elevator assembly **241** engaging the stop plate **171** to operate the switch S–7 and there is no cheese still remaining in front of ram III which would hold the normally closed switch S-8 behind the stop plate **274** in an open position. The solenoid SOL–11 is energized through the normally closed contacts **1** and **2** of relay RY–7. Energization of solenoid SOL–11 causes air to be supplied to the tank T–3 which urges fluid from the tank T–3 to the rear of the ram II to cause the plunger **261** to be advanced. Advancement of the plunger causes the block **264** to engage the next slice of cheese carried on the elevator **241** and to cause the same to be advanced through the first vertical cutting means **201** to cut the slice into a plurality (four for this example) of elongate blocks and to deposit the same upon the rollers **288** of ram III conveyor assembly **286.**

As pointed out previously at the forward of the stroke for the plunger **261** of ram II, the switch S–1 is operated. After the slice of cheese has been advanced through the first vertical cutting means **201,** the slice is deposited upon the rollers **288;** the stop plate **274** is again engaged by the cheese to cause operation of switch S–11. Switch S–11 causes energization of the solenoid SOL–12. Energization of solenoid SOL–12 causes air to be supplied to the tank T–4 which supplies fluid to the forward portion of ram II to cause the plunger **261** to be retracted. Fluid is returned to tank T–3 and excess air is exhausted through the exhaust member **109.**

Elevator Assembly 241 — Operation

When the ram II is returned to its home position, both switches **13** and **20** are operated. Now assuming that the elevator is not in its lowermost position, switch S–13 is ineffective because switch S–26 is not operated. Now assuming that there is cheese still on the elevator, switch S–14 will be in a closed position so that closing of switch S–20 is effective to cause energization of relay RY–7. Energization of relay RY–7 closes its contacts 3 and 4 to cause energization of up solenoid SOL–20 and closing of its contacts 6 and 7 causes energization of stop solenoid SOL–22. Holding circuits for relay RY–7 are established through switch S–17 and through contacts 3 and 4 of relay RY–7.

Energization of the stop solenoid SOL–22 opens the valve V–13. Energization of the solenoid SOL–20 causes air to flow from the piping **107** into tank T–9 to cause fluid to be supplied from tank T–9 to the bottom of cylinder VI to cause the plunger **247** to be raised and to thereby raise the elevator assembly **241.** Raising of the elevator assembly **241** continues until the top of the cheese on the elevator assembly engages the switch S–17 to operate the switch S–17 to open the holding circuit for the relay RY–7. Deenergization of the relay RY–7 opens its contacts 3 and 4, and 6 and 7 to deenergize the solenoids SOL–20 and SOL–22 to halt any further upward movement of the elevator assembly **241.**

In this manner, another slice of the block of cheese which heretofore has been positioned on the elevator assembly is moved upwardly so that it is in a position to be engaged by the ram II and to be advanced through the first vertical cutting means **201** as required by the wrapping machine **421.** Thus, it can be seen that each time a slice is moved by ram III through the second or supplemental vertical cutting means **331,** a new slice is advanced through the first vertical cutting means **201** by ram II. As soon as a new slice is required to be advanced by ram II, the elevator assembly **241** is raised by operation of the switch **20** a sufficient distance so that a new slice can be engaged by the ram II. This procedure continues until all of the slices of a block have been advanced by the ram II through the first vertical cutting means **201.**

After the last piece of cheese has been advanced off of the elevator assembly **241,** the elevator assembly is again initiated by operation of switch **20** and raises still further until the switch S–22 is operated by the operating member **251** (see FIG. **9**). Closing of the switch S–22 causes energization of relay RY–8. The circuit for energizing relay RY-8 is established through a normally open switch S–11 which is closed because ram II is in its home position. This switch prevents the elevator from being moved if ram II is not in its hom position. Energization of relay RY–8 causes its contacts 1 and 2 to close to establish a circuit for energizing the down solenoid SOL–21 through the normally closed contacts 5 and 6 of relay RY–7. The stop solenoid SOL–22 is energized through the closed contacts 3 and 4 of relay RY–8 and through the normally closed contacts 5 and 6 of relay RY–7. Energization of the solenoid SOL–21 causes air to be supplied to the tank T–8 and fluid to be supplied from the tank T–8 to the upper side of the cylinder VI to cause the cylinder VI and the elevator assembly **241** mounted thereon to be lowered. Operation of the stop solenoid SOL–22 opens the valve V–13 to permit fluid to flow from the other side of the cylinder VI to the tank T–8. A holding circuit is completed for relay RY–8 through contacts 5 and 6 of relay RY–8 and contacts 3 and 4 of switch S–26.

Downward movement of the elevator assembly is halted when the operating member **251** operates the switch S–26 to break the holding circuit for the relay RY–8. This deenergizes the solenoids SOL–21 and SOL–22.

The elevator assembly **241,** after it has returned to its lowermost position, requires another block of cheese which is delivered to it as hereinafter described. When a new block of cheese is delivered to the elevator assembly **241,** it moves on the rollers **244** of the elevator

assembly and continues its movement until it engages the stop plate **171** and operates the switches S–7, S–14 and S–23. As pointed out previously, the rollers **244** are provided with one-way clutch means **246** which prevents the block from bouncing away from the stop plate **171**.

When the elevator assembly **241** is in its lowermost position, upward movement of the elevator assembly is initiated by operation of the switch S–13 which is also operated when ram II is in it back or home position in the same manner as switch **20** is operated. However, in this event, switch **20** is ineffective to cause raising of the elevator because switch S–26 is operated. Switch S–13 completes the circuit for energizing the relay RY–7 through switch S–14 which causes energization of the solenoids SOL–20 and SOL–22 as hereinbefore described. This causes the elevator assembly **241** to be raised until the switch S–17 is operated to deenergize the holding circuit for relay RY–7. Deenergization of relay RY–7 deenergizes the solenoids SOL–20 and SOL–22. Thereafter, the raising of the elevator is under the control of the switch S–20 because as soon as the elevator is raised from the lowermost position, the switch S–13 is rendered ineffective by the opening of the switch S–26.

Operation of Centering Means **267** Before Ram III

The centering device or means **267** is operated at the same time as the ram II out solenoid SOL–11 is energized. Now let it be assumed that the elevator assembly **241** is in its lowermost position (top slice push-off position) and is not in motion. When this is the case, relay RY–6 is energized through normally open contacts 3 and 4 of switch S–26 which is operated when the elevator assembly **241** is down. Energization of relay RY–26 causes energization of relay RY–3. The circuit for energizing relay RY–3 is completed through contacts 5 and 6 of relay RY–6 and through the normally closed contacts 1 and 2 of relay RY–7 through switch S–9 and switches S–8 and S–7. A holding circuit for relay RY–3 is completed through its contacts 1 and 2 and pressure switch PS–2.

Energization of relay RY–3 causes energization of solenoids SOL–13, SOL–15, SOL–17 and SOL–19. Energization of the solenoid SOL–13 causes air to be supplied from the gripping **107** to the tank T–5 which causes fluid to be supplied to the rear end of the push cylinder VII since solenoid SOL–15 has opened valve V–5. Solenoid SOL–17 causes opening of valve V–7 so that fluid discharged from the push cylinder VII will be supplied to the rear sides of stop cylinders VIII and IX. As explained previously, since the cylinder VII and the cylinders VIII and IX are all the same diameter, the advance of the cylinders VIII and IX will be one-half the advance of the cylinder VII. The push cylinder VII continues its advance until the sensing plate **267** engages the cheese on the elevator assembly **241** and holds it against the framework of the first vertical cutting means **201**.

As the pressure builds up on the push cylinder VII, a pressure switch PS–2 is actuated at a predetermined pressure to cause energization of the relay RY–4 and to break the holding circuit for relay RY–3. Energization of the relay RY–4 causes energization of solenoid SOL–14, SOL–15 and SOL–16, and deenergization of solenoids SOL–13, SOL–17 and SOL–19. Energization of relay RY–4 establishes a holding circuit through its contacts 1 and 2 and the normally closed contacts of switch S–15.

Deenergization of solenoid SOL–17 locks the stop cylinders VIII and IX in the position to which they had been advanced by the fluid from the push cylinder VII so that they will be in a position to center the cheese in front of the ram III for the cutting operation in the additional vertical cutting means **331**. Energization of the solenoid SOL–14 causes valve V–3 to supply air to the tank T–6 which supplies fluid to the front of the push cylinder VII since solenoid SOL–16 has been energized to open valve V–6 to permit the push cylinder VII to be returned to its home position and out of the way of the cheese on the elevator and out of the way of the elevator assembly **241**. Operation of the solenoid SOL–15 opens the valve V–5 to permit the fluid from the other side of the push cylinder VII to be returned to the tank T–5. Switch S–15 is operated when the push cylinder VII returns to is home position to open the holding circuit for relay RY–4 to deenergize the same and solenoids SOL–14, SOL–15 and SOL–16.

The push cylinder VII is not operated again after it has once sensed the size of the block which has been positioned on the elevator assembly **241**. The stop cylinders VIII and IX are locked in position until all of the slices have been pushed off of the elevator assembly **241** by the ram II.

The stop cylinders VIII and IX are returned to their home or back positions after the last slice of the block on the elevator assembly has been pushed through the first vertical cutting means **201**. The stop cylinders VIII and IX are returned to their home positions by energization of relay RY–5 which energizes solenoids SOL–8, SOL–13, SOL–16, SOL–17 and SOL–18. Relay RY–5 is energized when switch S–22 is operated when the elevator reaches its uppermost position. This circuit is completed through the normally open contacts of switch S–11 and the normally open contacts of switch S–22. Energization of relay RY–5 also establishes a holding circuit for the same through contacts 1 and 2 of relay RY–5 and normally closed contacts of switch S–16.

Energization of the solenoid SOL–18 causes valve V–4 to supply air from the piping **107** to the tank T–7 which supplies fluid to the front ends of the cylinders VIII and IX to cause the fluid to be discharged therefrom through valve V–7 which has been opened by the solenoid SOL–17 through the valve V–6 which has been opened by the solenoid SOL–16 to return to tank T–6.

When the stop cylinders are returned to the home position, the normally closed contacts of switch S–16 are opened to break the holding circuit on relay RY–5 and to deenergize the solenoids which were previously energized by the relay RY–5. This completes a cycle and the centering means **267** is again adapted to be operated as soon as a new block of cheese has been positioned on the elevator assembly **241** in the same manner as hereinbefore described.

Operation of Elevator Feed Conveyor **111**

When the elevator assembly **241** is in its lowermost position, switch S–26 is operated. Switch S–23 is also operated when there is no cheese in engagement with the ram II stop plate **171** and, therefore, a circuit is completed through the normally open contacts 1 and 2 of relay RY–15 to the rectifier REC–1 to cause the

clutch solenoid SOL–31 to be energized and the brake solenoid SOL–32 to be deenergized to cause the elevator feed conveyor 111 to be advanced.

Advance of conveyor 111 continues until cheese strikes the stop plate 171 and opens the switch S23 to deenergize the clutch solenoid SOL–31 and energize the brake solenoid SOL–32. The motor 116 used for driving the brake-clutch mechanism 123, which is utilized for driving the elevator feed conveyor 111, is started in operation by manually operating the switch S–34 which energizes the relay RY–17 to establish a circuit for energizing the motor 116. A holding circuit for the relay RY–17 is established through the switch S–35. When it is desired to stop the motor 116, switch S–35 is opened.

Operation of the Length Sensing Means 131

Before the block of cheese is advanced onto the elevator assembly 241 by the elevator feed conveyor 111, the length of the block of cheese is sensed by the length sensing means 131. At the same time that the elevator assembly 241 is signalled to return to its lowermost position by the operation of the switch S–11 by the ram II advancing the last slice of cheese through the vertical cutting means 201, relay RY–8 is energized through the switch S–22 which has been closed by the elevator assembly moving to its uppermost position.

At the same time, relay RY-9 is energized through switches S–11 and S–22. Energization of relay RY–9 closed its contacts 3 and 4 to energize out solenoid SOL–23 and stop solenoid SOL–25 of the length measuring means. Energization of the solenoid SOL–23 causes valve V–8 to supply air from piping 107 to the tank T–10 which causes fluid to be supplied to the rear side of the cylinder V. Energization of solenoid SOL–25 permits fluid to return from the front side of the cylinder V to tank T–11. The plunger of cylinder V continues to move out to the end of its stroke until it operates the limit switch S–21 which opens the holding circuit which had been established for the relay RY–9 through contacts 1 and 2 of relay RY–9.

At the same time that relay RY–9 is deenergized, relay RY–10 is energized through switch S–21. Energization of relay RY–10 closes its contacts 3 and 4 to energize solenoid SOL–24 and closes its contacts 5 and 6 to energize solenoid SOL–25. Operation of solenoid SOL–24 causes air to be supplied from the piping 107 to the tank T–11 which supplies fluid to the front side of the cylinder V since the solenoid SOL–25 has opened the valve V–9. The cylinder V returns until the block of cheese casts a shadow on the photosensitive switch or cell PC–1 to open the holding circuit for the relay RY–10 which previously had been completed through contacts 1 and 2 of relay RY–10, switch S–30 and PC–1.

As pointed out previously, the cutting elements or wires 206 are adjusted by the movement of the cylinder V so that when the block of cheese is moved onto the elevator assembly 241 in front of the ram II, the cutting wires 206 are positioned in such a manner that the slices will be cut into elongate blocks having a width which is proportional to the length of the block which has been measured by the length sensing means so that there is no waste when the block is cut by the vertical cutting means 201. Thus, each block will be cut into the same number of elongate blocks with no waste even though the large blocks from which the elongate blocks are cut vary substantially in length.

It is possible for the length sensing means 131 to sense the length of the block in this manner because the position of the other end of the block is known, that is, it is at the position to which it was advanced by the ram I.

After the cutting wires or elements have been moved to the desired positions, the deenergization of the relay RY–10 by operation of the switch PC–1 causes the cutting wires to be locked in this position because the stop valve V–9 blocks the flow of any further fluid from the ram V because of deenergization of solenoid SOL–25.

In the event there is not a block of cheese on the elevator feed conveyor 111, the rearward travel of the plunger of the cylinder V is limited by the limit switch S–30.

Operation of Ram I

The block of cheese is placed on the elevator feed conveyor 111 so that its length can be measured by operation of ram I. The operation of ram I is initiated when relay RY–6 is energized at the time that switch S–26 is operated when the elevator assembly 241 returns to its lowermost position. Energization of relay RY–6 causes energization of the out solenoid SOL–26 when switch S–24 is closed indicating that there is cheese against the ram I stop plate 91 and through normally open contacts 3 and 4 and normally open contacts 1 and 2 of relay RY–6 through switch S–13. Energization of the solenoid SOL–26 causes the valve V–10 to supply air from the piping 107 to the tank T–12 which supplies fluid to the rear side of ram I to cause the plunger 93 to be advanced. The plunger 93 advances the block of cheese before the ram I stop plate 91 through the horizontal cutting means 56 to cut the block into a plurality of superposed slices and to position those slices upon the elevator feed conveyor 111.

The plunger 93 of ram I continues to advance until switch S–25 is operated. Operation of switch S–25 causes energization of the solenoid SOL–27. Energization of solenoid SOL–27 causes air from piping 107 to be supplied to the tank T–13 and causes fluid to be supplied from the tank T–13 to the front side of ram I to cause plunger 93 to be returned to its home position.

Operation of Bulk Feed Conveyor 31

At the time that the switch S–25 is operated by the advance of the plunger 93 of ram I, the relay RY–11 is also energized through the switch S–25 through the normally closed contacts 5 and 6 of relay RY–16. A holding circuit for relay RY–11 is completed through its contacts 1 and 2 and the normally closed contacts of switch S–38 and the normally closed contacts provided by photocell PC–3. Energization of the relay RY–11 closes its contacts 6 and 7 to cause rectifier REC–2 to cause energization of the clutch solenoid SOL–34 and deenergization of the brake solenoid SOL–33 of the clutch brake unit 39 to cause the bulk feed conveyor 31 to be advanced. Conveyor 31 advances until the block of cheese carried thereby casts a shadow upon the photocell PC–3 to cause it to open the holding circuit for the relay RY–11. Relay RY–11 is, therefore, deenergized which causes deenergization of the clutch solenoid SOL–34 and energization of the brake solenoid SOL–33.

The relay RY–11 can also be deenergized by energization of relay RY–16. Relay RY–16 is energized when switch S–49 which forms a part of the metal detector 41 is operated. Energization of relay RY–16 opens contacts 5 and 6 which form a part of the circuit for energization of the relay RY–11. Energization of the relay RY–16 causes closing of its contacts 6 and 7 which energizes the light L–1 to indicate that the metal detector has detected a metal object in the block of cheese. When it is desired to reset the metal detector, the relay RY–16 can be deenergized by operation of the reset switch S–39 to open the holding circuit for relay RY–16.

The ram I feed conveyor 13 is driven when the bulk feed conveyor 31 is driven. This is accomplished by operating the brake clutch mechanisms 21 and 39 in parallel, that is, by connecting the clutch solenoids of both in parallel and the brake solenoids of both in parallel. Thus, both conveyors 13 and 31 are under control of relay RY–11.

Operation of Height Measuring Means 48

The height measuring means operates in a manner very similar to the length sensing or measuring means 131 hereinbefore described. The operation of the height sensing means is initiated by the switch S–27 which is operated on the return of ram I to its home position. Operation of the switch S–27 causes energization of relay RY–12. Energization of relay RY–12 causes closing of its contacts 3 and 4 to cause energization of solenoid SOL–28 and closing of its contacts 5 and 6 to cause energization of the stop solenoid SOL–30. Energization of the solenoid SOL–28 causes the valve V–11 to cause air to be supplied from the piping 107 to the tank T–14 to cause fluid to be supplied to the lower side of the cylinder IV. Valve V–12 is opened by energization of solenoid SOL–30 to permit fluid to return from the upper side of the cylinder IV and causes the plunger of cylinder IV to be raised. Raising of the plunger of the cylinder IV continues until the limit switch S–28 is operated to open the holding circuit for relay RY–12 which had been completed through the switch S–28 in its uppermost position as shown in FIG. 28B. Deenergization of the relay RY–12 deenergizes the up solenoid SOL–28 and the stop solenoid SOL–30.

Operation of the switch S–28 causes energization of the relay RY–13. A holding circuit for relay RY–13 is completed through switch S–29 and through the photocell switch PC–2 and contacts 1 and 2 of relay RY–13. Energization of relay RY–13 through its contacts 3 and 4, and 5 and 6 causes energization of the down solenoid SOL–29 and the stop solenoid SOL–30. Energization of the solenoid SOL–29 causes the valve V–11 to supply air from the piping 107 to the tank T–15, and the tank T–15 supplies fluid through the valve V–2 which is open because of energization of solenoid SOL–30 to the upper side of the ram of cylinder IV to cause the plunger of cylinder IV to move downwardly. Downward movement of the plunger of ram IV continues until the shadow from the block of cheese, the height of which is being measured, strikes the photocell PC–2 to cause opening of the holding circuit for the relay RY–13 to stop the downward movement of the cylinder IV. The cylinder IV is locked in this position because the down solenoid SOL–29 is deenergized as is the solenoid SOL–30 to prevent any further flow of fluid from the cylinder IV.

In the event that the block of cheese is shorter than the limits set or there is no block of cheese on the ram I feed conveyor 13, downward movement of the plunger ram IV will continue until the switch S–29 is operated which will also cause breaking of the holding circuit for the relay RY–13 to again stop further downward movement of the cylinder IV.

As hereinbefore described, the horizontal cutting means 56 is directly connected to the plunger of the cylinder IV so that the cutting elements or wires 61 are proportionally positioned within the frame of the horizontal cutting means so as to cut the block into the same number of slices each time with each having substantially the same height without any waste. The distance between the cutting elements is directly proportional to height measured.

Operation of Ram I Feed Conveyor

After the height measurement of the block of cheese has been completed by operation of the height measuring means 48, the operation of the photocell PC–2 completes a circuit for energization of the relay RY–14. A holding circuit for relay RY–14 is completed through its contacts 1 and 2 and through switch S–24. Energization of relay RY–14 causes the rectifier REC–3 to energize the clutch solenoid SOL–36 and deenergize the brake solenoid SOL–35 of the clutch brake assembly 18 to drive the ram I feed conveyor. Operation of the ram I feed conveyor continues and advances the block of cheese until it strikes the ram I stop plate 91 to cause operation of the switch S–24 and to break the holding circuit for relay RY–14 to stop the driving of the ram I feed conveyor.

From the operation thus far described, it can be seen that the operation is completely controlled from the wrapping machine 421 and operates in a timed relationship with the wrapping machine 421 so that consumer sized blocks of cheese to be wrapped are delivered in a timed relationship to the wrapping machine. It can be seen that the bulk feed conveyor 31 and the ram I feed conveyor 13 advance the blocks one by one in succession. The horizontal cutting means 56 forms a first cutting means which has a plurality of cutting elements disposed in spaced parallel planes. Ram I serves as means for advancing the block through the cutting means to cause the block to be cut into a plurality of superposed slices. The elevator feed conveyor 111 serves as means for advancing the slices onto the elevator assembly 241. The vertical cutting means 201 serves as additional cutting means and includes vertical cutting elements. The ram II serves as means for advancing the superposed slices one by one through the additional cutting means to cause each of the slices to be cut into a plurality of elongate blocks. The ram III conveyor assembly 286 receives the elongate blocks from ram II. Supplemental cutting means is formed by the additional vertical cutting means 331. The ram III serves as means for advancing the elongate blocks through the supplemental cutting means to cause each of the elongate blocks to be cut into large separate parts and causes the same to be deposited upon a delivery conveyor 341.

Operation of Delivery Conveyor 341 and Additional Delivery Conveyor 351

After the consumer-sized blocks have been deposited in juxtaposed positions upon the first delivery conveyor 341, the blocks are advanced under the control of the wrapping machine. However, in this case, movement is controlled by switch S–45. Each time that one additional row of consumer-sized blocks is delivered to the wrapping machine, which in the present example is assumed to consist of two consumer-sized blocks which advance abreast. Upon closing of switch S–45, relay RY–22 is energized which causes the rectifier REC–4 to cause energization of the clutch solenoid SOL–36 and deenergization of the brake solenoid SOL–37 of the brake-clutch unit 397 to advance the delivery conveyor 341.

Advance of the delivery conveyor 341 continues until the blocks which are carried thereon cast a shadow on the photocell PC–4. As soon as this occurs, the photocell causes operation of the pulser 574 which causes operation of the relay RY–3 to open its contacts 1 and 2 and thereby open the holding circuit for the relay RY–22 which was completed through its contacts 1 and 2. Opening of the holding circuit for relay RY–22 stops the advance of the delivery conveyor 341 by causing energization of the brake solenoid SOL–37 and deenergization of the clutch solenoid SOL–36.

Upon the next closing of the switch S–45, the relay RY–22 is again energized to again cause energization of the clutch solenoid SOL–36 and deenergization of the brake solenoid SOL–37 to again start the blocks of cheese moving. It will be noted, as can be seen from FIG. 24A, that the photocell PC–4 is positioned very near the end of the first delivery conveyor 341 so that the blocks also underlie the rollers 406, as shown in FIG. 27B. After the first delivery conveyor 341 is again started, the blocks are advanced so that they come into engagement with the rollers 413 associated with the additional delivery conveyor 351 and are carried onto the chain belts 352 of the additional delivery conveyor. In view of the fact that the additional delivery conveyor 351 with the associated rollers 413 are advancing more rapidly than the conveyor 341 and its associated rollers 406, the leading juxtaposed blocks are separated from the succeeding blocks as shown in FIG. 27D to provide increasing space so that light can again shine on the photocell PC–4 as shown in FIG. 27E.

As soon as the next succeeding row of blocks begins to cast a shadow upon the photocell PC–4, the relay RY–23 is again operated to break the holding circuit for RY–22 to stop the first delivery conveyor 341.

The blocks which are advanced onto the additional delivery conveyor 351 are advanced by the delivery conveyor 351 in a timed relationship because the conveyor 351 is driven directly by the wrapping machine. At the forward end of the conveyor, the blocks travel onto the channel-shaped members 360 and are raised slightly above the tops 356 of the chain belt and permit the chain belt to advance under the same until the upstanding lugs 357 engage the trailing edges of the blocks. The lugs 357 thereafter advance the blocks into the conveyor of the wrapping machine. Since the lugs are positioned on the conveyor chain, it can be seen that the blocks are advanced in a precision manner into the conveyor of the wrapping machine with the desired spacing.

With the first delivery conveyor 341 and the additional conveyor 351, it can be seen that a plurality of blocks can be taken which are immediately adjacent to each other and separated into separate rows so that they can be advanced row by row into the wrapping machine.

In the foregoing description, it will be recalled that it was assumed that each slice which was cut from the block was cut into eight consumer-sized blocks such as shown in FIGS. 29A and 30E. It should be appreciated that the present apparatus can be utilized for cutting a block into any desired number of consumer-sized blocks. For example, alternative cutting arrangement are shown in FIGS. 30A, 30B, 30C and 30F. In the arrangement shown in FIG. 30A, it can be seen that it is only necessary to provide the additional vertical cutting means 331 with an additional vertical cutting element to provide two cuts instead of one cut as in FIG. 30E. For FIG. 30B, it can be seen that it is only necessary to provide the first vertical cutting means 201 with four vertical cutting elements instead of three vertical cutting elements as in FIG. 30E. For FIG. 30C, it can be seen that it is merely necessary to provide the first vertical cutting means 201 with six vertical cutting elements rather than three vertical cutting elements as required for the cutting and slicing arrangement shown in FIG. 30E. For the arrangement shown in FIG. 30F, it is merely necessary to provide the first vertical cutting means 201 with six vertical cutting elements and the second or additional vertical cutting means 331 with two vertical cutting elements. Thus, it can be seen that in the arrangement shown in FIG. 30E, each slice cut from the block is cut into eight consumer-sized blocks. In FIG. 30A, each slice is cut into 12 consumersized blocks; in FIG. 30B, each slice is cut into 10 consumer-sized blocks; in FIG. 30C, each slice is cut into 14 consumer-sized blocks; and each slice in FIG. 30F is cut into 21 consumer-sized blocks.

Any of the cutting arrangements shown above can be readily accomplished with the apparatus merely by utilizing vertical cutting means 201 and 331 with the required number of cutting elements. As hereinbefore explained, the vertical cutting means 201 and the additional vertical cutting means 331 can be readily removed from the apparatus and other vertical cutting means substituted having the required number of vertical cutting elements to perform the cutting or slicing operations desired.

The additional delivery conveyor 351 can be readily adjusted to accommodate rows having either two or three blocks in a row merely by operating the elver arm 371 as hereinbefore described and to deliver them in a timed relationship to the wrapping machine 421.

The pulse accumulator 456 is set in accordance with the number of consumer-sized blocks to be cut from each slice.

Operation of the Apparatus for Die Cutting

As hereinbefore explained, the apparatus is provided with means whereby each slice cut from a large block can be cut with dies to form a plurality of die-cut consumer-sized blocks as shown in FIGS. 29B and 30D.

Before the die cutting operation is commenced, the ram III conveyor assembly 286 is moved to an out-of-the-way position as shown in FIG. 1A and the platform 471 is put in place on the frame 11. The frame 234 re-

places the vertical cutting means **201** and the additional vertical cutting means **331** is removed.

After the above steps have been completed, the switch S–**48** in the pulse accumulator **456** is operated to energize the relay RY–**20** to thereby place the apparatus in condition for die cutting. Next let it be assumed that the wrapping machine **421** has just completed the wrapping of eight of the die-cut consumersized blocks and that it is necessary to cause the apparatus to place eight additional consumer-sized blocks on the delivery conveyor **341.** Thus, when the pulse accumulator **456** has counted eight pulses from the switch S–**46** operated by the wrapping machine **421,** the switch S–**47** is closed by the pulse accumulator **456** assuming that the pulse accumulator has been set for eight pulses which is the case when the apparatus is being used for die cutting.

Closing of the switch S–**47** by the pulser causes energization of the indexing solenoid SOL–**3.** This is accomplished through S–**47,** through normally closed switch S–**1,** through normally open contacts **2** and **3** of relay RY–**20,** through normally closed contacts **1** and **2** of relay RY–**11,** through normally open switches S–**18** and S–**19** which are closed because the product push-out cylinder XI and the trim push-out cylinder XII are in the up positions. From examining FIG. **26**A, it can be seen that energization of the solenoid SOL–**3** causes the valve **16** to supply air from the piping **107** to the tank T–**21.** The tank T–**21** supplies fluid to the indexing cylinder XIII to cause the index table to be operated to cause the sleeve **478,** which serves as a vertical standard, and the cross-shaped member **501** with the die cutting assemblies **504** secured thereto to be rotated through or stepped 90°.

Operation of the index cylinder **13** also causes operation of normally closed switch S–**4** which causes energization of the cocking solenoid SOL–**4.** Energization of the solenoid SOL–**4** causes valve V–**16** to be operated to supply fluid from the piping **107** to the tank T–**22.** Fluid is then supplied to the cylinder XIII to return the cylinder XIII into its home position. Return of the cylinder XIII to its home position also causes cocking of the ratchet mechanism provided as a part of the index table so that the index table will be in a position to be indexed or advanced the next 90° step upon a new work stroke by the indexing cylinder XIII. The indexing table is also provided with internal mechanism (not shown) which is conventional which prevents the sleeve **478** from rotating after it has been indexed until another signal is received to cause the index cylinder XIII to operate again.

At the same time that switch S–**4** is operated, relay RY–**2** is energized. This circuit is completed through normally open switch S–**4** through contacts **7** and **8** of selector relay RY–**20,** through the normally open contacts of switch S–**2** (switch S–**2** will be closed because cheese is in position in front of the stop plate **274**), and through normally open contacts **5** and **6** of relay RY–**20** to the coil of relay RY–**2.** Relay RY–**1** is energized at the same time that relay RY–**2** is energized. A holding circuit for relay RY–**1** is established through the normally closed contacts of switch S–**5** and through contacts **3** and **4** of relay RY–**1.**

Energization of the relay RY–**1** causes closing of its contacts **5** and **6** to cause energization of the up solenoid SOL–**5** through manual switch S–**37** which is closed. Energization of the up solenoid SOL–**5** causes the valve V–**17** to be operated to supply fluid from piping **107** to tank T–**23.** Fluid is supplied from tank T–**23** to the lower portion of the die-cut ram XIV to cause the plunger to be raised and to engage the platform or table **471** to move the table **471** with the slice of cheese carried thereon upwardly. Movement of the table continues and urges the slice of cheese into engagement with the die cutting members **521** to cause a plurality of consumer-sized blocks to be cut from the slice of cheese as, for example, eight semi-cylindrical blocks as shown in FIG. **30**D. It will be appreciated that substantial pressures are exerted against the die cut members **521.** However, the die cut members **521** are held in a stationary position by the support rods **511** which are rigidly secured to the lower plate **509** and the framework **506.** The framework **506** is supported against deformation by the support members **512** which are carried by the cross-shaped member **473.**

Upward travel of the die cut ram XIV is limited by switch S–**5.** Switch S–**5** is momentarily operated by the operating member **566** carried by the platform **471** and opens the holding circuit for the relay RY–**1** and deenergizes relay RY–**1.** At the same time, it closes its normally open contact to energize the down solenoid SOL–**6.** Energization of the down solenoid SOL–**6** causes the valve V–**17** to be operated to supply air from the piping **107** to the tank T–**24** which supplies fluid to the upper side of the die cut ram XIV to cause it to be lowered.

At the same time that relay RY–**2** is energized to start movement of the die cutting ram XIV, the product push-out mechanism is operated by energization of the solenoid SOL–**7** through the contacts **3** and **4** of relay RY–**2.** Energization of the solenoid SOL–**7** causes the valve V–**18** to be operated to supply air from the piping **107** to the tank T–**26** which causes fluid to be supplied to the upper part of the product push-out cylinder **11.** Operation of the product push-out cylinder **11** causes movement downward of the plunger **551.** The plunger **551** engages the shaft **546** which causes the plate **513** to be moved downwardly carrying with it the posts **523** and the product push-out members **522** to move the product push-out members **522** downwardly in the die cut members **521** to push the product out of the die cut members and to cause it to drop onto the delivery conveyor **341.** The product push-out cylinder **11** has a stroke which is only sufficient to cause the product push-out members **522** to be moved to the bottom portions of the die cut members **521.**

When the product push-out members **522** have been moved downwardly sufficiently far enough to push the consumer-sized die cut blocks from the die cut members **521,** the return switch S–**6** is operated to close its normally open contacts to cause energization of the up solenoid SOL–**8.** Energization of the up solenoid SOL–**8** causes the valve V–**18** to be operated to supply air from piping **107** to the tank T–**25** which supplies fluid to the lower part of the product push cylinder **11** to cause the plunger **551** to return to its home position. The springs **518** cause the upper plate **513** and the product push-out members **522** carried thereon to be moved upwardly into their normal positions as shown in FIG. **20.**

Energization of relay RY–**2** also causes energization of the trim push-out means by energization of the down solenoid SOL–**9** through contacts **5** and **6** of relay RY–**2.** Energization of the down solenoid SOL–**9** causes operation of valve V–**19** to supply air from the piping

107 to the tank T–27 which causes fluid to be supplied to the upper part of the trim cylinder 12 to cause the plunger 552 to be moved downwardly to engage the shaft 546. Movement of shaft 546 causes the plate 513 to be moved downwardly against the force of the springs 518 and to carry with it trim push-out members 526 and to move the same downwardly to force out from between the die cut members the portions of the slice of cheese remaining. In addition, the plate 513 engages the collars 536 on the rods 529 to move the trim push-out blocks 528 downwardly to cause any pieces of cheese retained by the fingers 538 to also be pushed downwardly and out away from the die cut members 521. The trim which is pushed out by the members 526 and 528 is dropped downwardly into a bag 556 carried on the main frame 11.

It should be pointed out that the fingers 538 yieldably engage any pieces of cheese around the outer portions of the die cut assembly formed by the die cut members 521 so that they will not drop away from the die cut members 521 during the time that the product is being pushed out.

Downward travel of the plunger 522 is limited when the switch S–12 is operated to close its normally closed contacts to energize the solenoid SOL–10. Energization of solenoid SOL–10 causes air to be supplied in the piping 107 to the tank T–28 which causes fluid to be supplied to the lower portion of the trim cylinder 12 to cause it to be raised.

It will be noted that when the product push-out cylinder 11 and the trim push-out cylinders 12 are operated, the switches S–18 and S–19 are operated. This prevents operation of the indexing circuit as hereinbefore described to prevent indexing of the die cut assemblies during the time that the die cutting, product push-out and trim push-out operations are taking place.

The operation of the remaining portion of the apparatus is substantially identical to that hereinbefore described in cutting rectangular consumer-sized blocks. Thus, each time a slice is raised by the platform 471 by the ram XIV and the ram lowered to return the platform 471 to its home position, the switch S–10 is operated to cause operation of ram II in the manner hereinbefore described. Switch S–10 is not effective on the upstroke of ram XIV. The only difference in this case is that the ram II does not advance the slice through the vertical cutting means 301. The elevator assembly 241 is operated in the same manner as is the elevator feed conveyor 111 and the ram I feed conveyor 13 and the bulk feed conveyor 31.

As pointed out previously, there is one additional step, however, which takes place when the block cut into superposed slices is advanced onto the elevator assembly 241. In this case, the centering means 175 before ram II is connected in the manner shown in FIGS. 10 and 11 and positions the stop plate 171 so that its position is proportional to the length of the block measured by the length sensing means 131. In this manner, the slices of cheese which are advanced off of the block by ram II are centered for placement upon the platform 471 so that they will be centered with respect to the die cutting elements 521 forming a part of the die cutting mechanism 472.

It will be noted that each of the die cutting assemblies 504 of the die cutting mechanism 472 are each movable step by step through 90° increments into four different sectors. The first sector is when the die cutting assembly 504 overlies the platform 471 and is in a die cutting position. The next is 90° removed therefrom and can be identified as a product pushout sector in which the die cutting assembly 504 overlies the delivery conveyor 341. The next sector can be called a trim push-out sector which is removed 90° from the product push-out sector and which overlies the bag 556. The other remaining sector is unused in the present embodiment of the invention. The cheese is advanced in the manner shown in FIG. 29B.

The conveyors 341 and 351 operate in the same manner as when they are used for advancing rectangular sized consumer blocks.

It is apparent from the foregoing that we have provided a new and improved apparatus for the cutting and handling of articles and more in particular consumer-sized blocks which can be readily fed to automatic machinery such as automatic wrapping machines. As will be pointed out from the foregoing, the apparatus is particularly adapted for use in cutting large blocks into smaller consumer-sized blocks and feeding them automatically into the wrapping machine. Although the operation of the apparatus has been described primarily in conjunction with cheese, it is readily apparent that the principles of the present invention can be utilized for other cutting and handling operations. The apparatus is particularly advantageous in that it eliminates the use of practically all manual labor and makes it possible to automate heretofore largely manual operations.

We claim:

1. In apparatus for cutting and handling articles, a standard, a framework rotatably mounted on said standard, a plurality of frames mounted on said framework, a plurality of dies carried by each of said frames, a platform, means for advancing one of the articles onto the platform, means for causing step by step rotational movement of the framework on the standard so that each of the frames is moved in succession into alignment with an article on the platform, means for causing relative movement between the article on the platform and the dies of the frame in alignment therewith so that the dies cut parts of predetermined shapes from the article, means for causing the parts cut from the article to be ejected from the dies in a region spaced from the platform, means for receiving the parts ejected from the dies, and means for causing remnants of the article to be ejected from around the dies in a region spaced from the platform and a region spaced from the region in which the parts are ejected.

2. Apparatus as in claim 1 wherein each of said frames includes a plurality of posts depending from said framework, a lower plate secured to the lower ends of said posts, said dies being secured to said lower plate and depending therefrom, an upper plate slidably mounted on said rods and disposed above said lower plate, means yieldably urging said upper plate into a position spaced above said lower plate, and wherein said means for causing the parts cut from the article to be ejected from the dies consists of product push-out members disposed in the dies, means for supporting the product push-out members from the upper plate, and means for causing downward movement of the upper plate and the product push-out members to cause the parts to be ejected from the dies.

3. Apparatus as in claim 2 wherein said means for causing remnants of the articles to be ejected from

around the die consists of a plurality of blocks and means for securing the blocks to the upper plate, and means for moving the upper plate downwardly with respect to the lower plate to cause the blocks to be moved downwardly to eject remnants of the articles from around the dies.

4. In apparatus for cutting and handling articles, a standard, a framework rotatably mounted on said standard, a plurality of frames mounted on said framework, each frame including a lower plate, a plurality of dies carried by each of said frames, a platform, means for advancing one of the articles onto the platform, means for causing step by step rotational movement of the framework on the standard so that each of the frames is moved in succession into alignment with an article on the platform, means for causing relative movement between the article on the platform and the dies of the frame alignment therewith so that the dies cut parts of predetermined shapes from the article, means for causing the parts cut from the article to be ejected from the dies in a region spaced from the platform, means for receiving the parts ejected from the dies, means for causing remnants of the article to be ejected from around the dies in a region spaced from the platform and a region spaced from the region in which the parts are ejected, and movable means for retaining remnants mounted on the lower plate during the time that the parts are being ejected from the dies.

5. Apparatus as in claim **2** wherein said means for retaining remnants includes a plurality of spaced fingers, means for loosely mounting said fingers on the plates, and means for yieldably urging the fingers into engagement with the dies to hold remnants of the article to the dies.

6. In apparatus for cutting and handling articles, a platform for receiving articles and means for advancing the articles one by one onto the platform, a framework, a plurality of frames mounted on said framework, each of said frames carrying a plurality of dies, means for causing said frames to move through first, second and third positions, means for causing relative movement between the article carried on the platform and the dies carried in one of the frames when said one frame is in the first position for causing the dies to cut parts of predetermined configurations from the article, means causing the parts cut from the article to be ejected from the dies in the second position of the frame, means for receiving the parts ejected from the dies, and means for causing any remnants of the article to be ejected from around the dies in the third position of the frame.

7. Apparatus as in claim **6** wherein said framework includes a vertical standard, step by step rotating means mounted on the standard, and means mounted on the standard and connecting the step by step rotating means to the frame.

8. Apparatus as in claim **7** wherein said means for causing relative movement consists of means for moving the platform with the article thereon into engagement with the dies carried by the frame in the first position and for moving the platform away from the dies and into a position for receiving another article from the means for advancing articles onto the platform.

9. Apparatus as in claim **6** wherein the means for causing the parts cut from the article to be ejected from the dies in the frame in the second position and the means for causing any remnants of the article to be ejected from around the dies in the third position of the frame include means mounted on the standard and adapted to engage the frame to cause the parts cut from the dies to be ejected from the die and separate means mounted on the standard and adapted to engage the frame to cause remnants of the article to be ejected from around the dies.

10. In apparatus for cutting and handling articles having a predetermined configuration, a frame, a plurality of dies carried by said frame, each of said dies being of a size substantially less than the article and having a configuration different from the article, means for advancing the articles one by one toward the frame, means for causing relative movement between the frame and each article so as to cause the dies to cut parts having the configuration of the dies from each article and so that the parts which are cut are ejected from the dies, conveying means for receiving the parts ejected from the dies and for advancing the same away from said dies, said dies causing remnants to be formed when the parts are formed, means for causing said remnants to be discharged from said dies to a region separate from and out of register with the conveying means for said parts ,and means for collecting said remnants.

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